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Drivers and material pushed to the limit: endurance racing is the ultimate test of durability in motorsports. The year 2023 ushers in a new era for one of the most important and prestigious forms of motorsports with the new prototype class – Le Mans Daytona hybrid (LMDh). Bosch Motorsport is lining up to prove its expertise, endurance, and performance as the supplier of the unified hybrid system.

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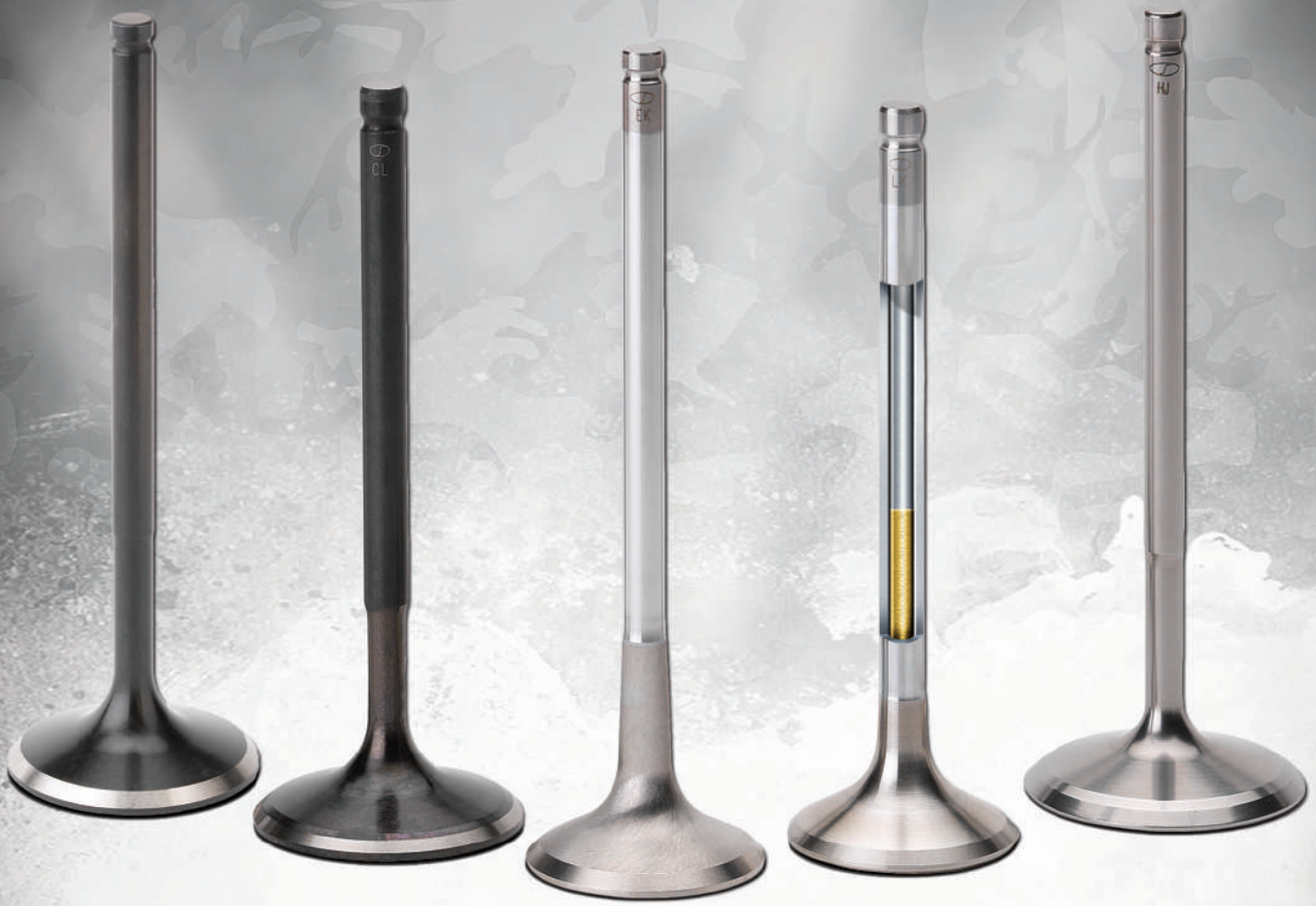

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NO ONE CAN HEAR YOU SCREAM...

AN iconic line, "In space, no one can hear you scream", clouded my thinking the other day, prompted by the argument that Formula 1 should return to V10 engines.

At first, I thought the link must be the scream of the V10s, the question of whether our next F1 'space race' would *really* revolve around an engine configuration we waved goodbye to in 2005?

Then I realised that no, the whole issue was so bonkers that it simply made me want to vent my frustration out loud!

That screaming tagline resonates with a certain generation. It dates back to 1979, from the film *Alien*. Race Tech is showing its age, you might think? Yet it seemed quite appropriate for two reasons.

First, because the suggestion gathering pace that Formula 1 should return to V10s is, in itself, a bit retro. It seems incongruous for a sport that prides itself on being in the technological vanguard to so brutally turn back the clock.

Second, have the aliens suddenly taken over? How else could you account for this bizarre turn of events where the manufacturers are already estimated to have spent £400 million each on the switch to the next generation of V6 hybrid power units, all signed and sealed, but suddenly, just months from 'going live', we are considering ripping up the plan?

And if we were to contemplate the unthinkable, why would we even be talking about V10s? It's hardly as if the modern OEMs are flocking to them!

You can read the intricacies of this bizarre affair in Andrew Benson's feature in this month's magazine. Elsewhere, Sergio Rinland also weighs in with some interesting – not to mention controversial – opinions.

Those arguing for a return to simpler, cheaper engines may well have a point. With the automotive landscape shifting so swiftly, it's probably good to have the debate. What definitely *isn't* prudent, is the ridiculous timing!

What message, I wonder, does this send to the boardrooms of Audi, Ford, Cadillac and Honda, all of whom have been lured in, or back, to F1 thanks to the 2026 regulations.

Some have grizzled for years that they wanted more noise returned to the sport. If we are not careful, we will hear a noise, alright: the sound of Formula 1 shooting itself in the foot...

Mark Skewis
EDITOR

"BATTLE OF TECHNOLOGIES" BECOMES BATTLE FOR SURVIVAL

World motorsport's governing body steps in to rescue World RX Championship. By **Mark Skewis**

THE Fédération Internationale de l'Automobile (FIA) has stepped in to save the imperilled FIA World and European Rallycross Championships.

When the 2025 World RX calendar was originally revealed, it looked, on paper, a tantalising prospect: the championship's Unique Selling Point, a "Battle of Technologies" pitting internal combustion-engine cars against their fully electric rivals, seems perfect for the fast-changing automotive landscape. The calendar too, looked impressive, featuring a return to North America for a maiden ice race; a street race in Coventry in the UK; and an inaugural Australian race weekend.

The reality, however, was somewhat different. The series has never fully recovered from a number of false starts that bedevilled its transition to the EV era, spooking the manufacturers and sending them hurrying for the exit door.

A truncated 2023 season, marred by a court case in the wake of a bad fire at Lydden Hill, further sapped confidence. With declining entries, no promoter and no certainty over its future direction, the series was on its knees.

But cometh the hour... cometh the FIA! The governing body will take over the operation of the series with immediate effect. The FIA will own and operate the championships, albeit with "the support of a service provider".

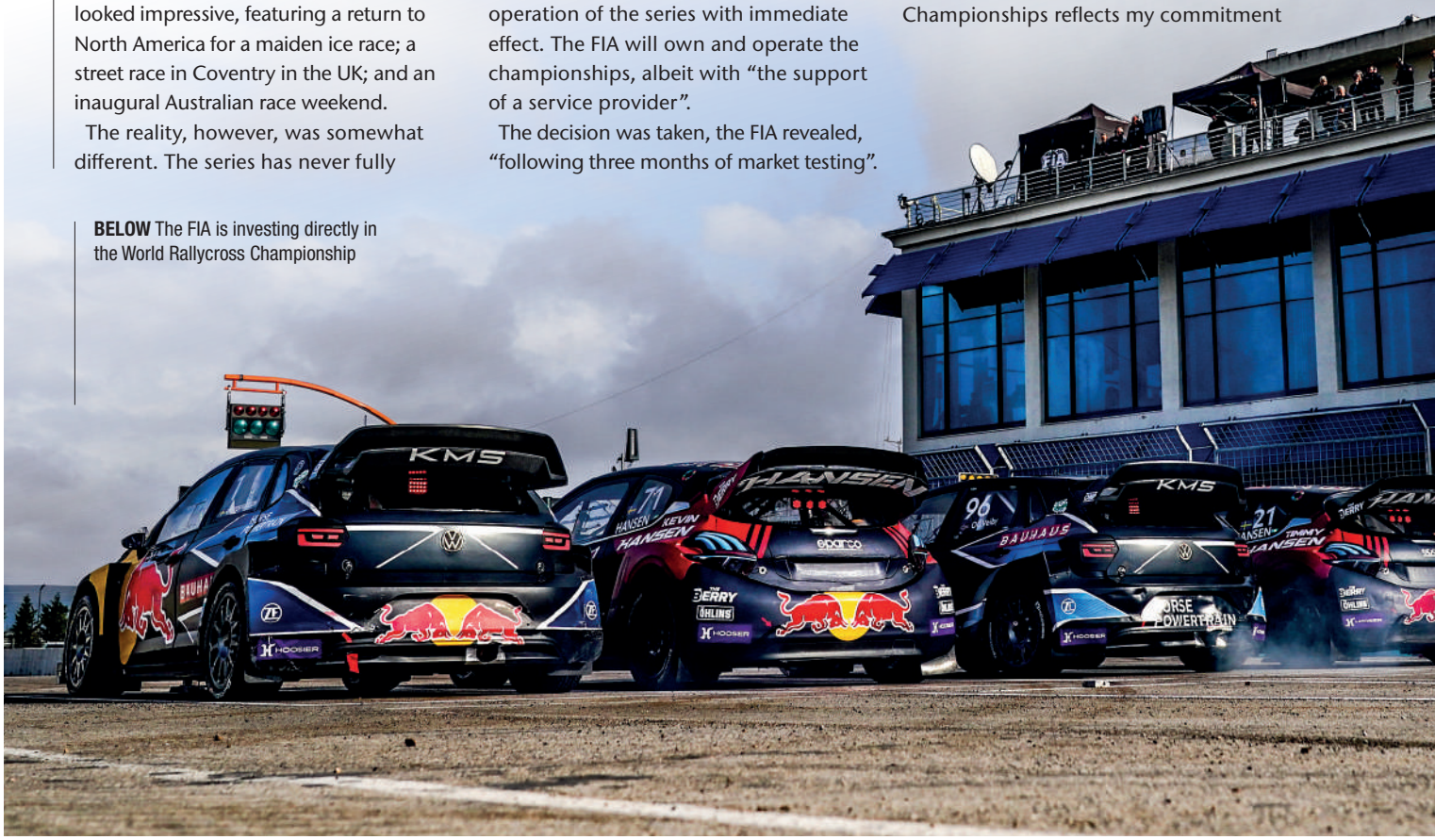
The decision was taken, the FIA revealed, "following three months of market testing".

Calendars have been revised, the Battle of Technologies concept remains, and the FIA is prioritising free-to-air coverage and digital accessibility in its bid to kickstart this new era. The TV deal is seen as a crucial tool in order for the championships to reach new fans and provide additional value to commercial partners and sponsors.

So, all good? As yet, the jury remains out. A degree of scepticism remains within the rallycross ranks, not least regarding plans for the sport's 2027 regulations to align with world rallying. In the short-term, however, just getting to 2027 with a championship intact would represent a good result.

FIA President Mohammed Ben Sulayem said: "The FIA is making an investment not only in Rallycross, but in the future of our sport. We are fully committed to take this category to the next level by securing new global audiences, delivering the opportunity for an improved competition for the drivers, teams, our commercial partners, and crucially the fans.

"When I was elected, I pledged to deliver strong regulations and a stronger FIA, building an essential foundation for the success of motor sport at every level. Securing the future growth of our World Championships reflects my commitment



BELOW The FIA is investing directly in the World Rallycross Championship

to do just this."

In a further boost, Volvo Construction Equipment and Hoosier Racing Tire Europe have confirmed their intentions to continue as Official Track Building Partner and as the Official Tire Supplier for the FIA World and European Rallycross Championships.

The investment by the FIA in the highest levels of the rallycross discipline also indicates its commitment to develop the entire progression pathway for off-road motorsport. There is a focused strategy to work collectively with National Sporting Authorities (ASNs) to strengthen this pathway, starting from entry-level cross-car events, with clear, accessible steps from national and regional competition through to the top level of the FIA World Rallycross Championship.

FIA Junior Road Sport Director, Emilia Abel, said: "The championship has huge potential to grow and develop at a global level and I am confident that this new opportunity for the FIA to operate the championship brings with it a bright future.

"The FIA will put fans and competitors at the heart of the work that is to come. All of us are looking forward to the 2025 season and being a part of this new era of Rallycross." RT

Photos: Red Bull Content Pool

"We can restore Rallycross to where it belongs"

Fourteen-time FIA European Rallycross Champion welcomes rescue deal

"**I THINK** what's coming now is the best that could come out of it, that the FIA really takes charge of it and leads us into the future," commented Kenneth Hansen, a rallycross legend as a driver and now a deeply committed team principal.

"The FIA is our lead organization, and when they take us on board, it shows that it is something they believe in, because they could also have said, 'Okay, it doesn't look good, so we'll just stop it', then the World Championship would have been gone. But that's not the way they look at it.

"We are thankful for the hard work and dedication of President Mohammed Ben Sulayem and his team at the FIA which will now ensure the growth of our sport, from Cross-Cars at the grassroots level to the pinnacle of the FIA World Rallycross Championship. We look forward to working closely with the FIA in the coming months to turn the potential of rallycross into an exciting reality. We are confident that together we can restore our beloved sport to where it belongs as a global off-road spectacle!"

Although he has carved out an unparalleled career in rallycross, etching an indelible mark on the sport's record books, Hansen knows about both ends of the sport. He started his career at the bottom of the ladder in 1983 with an old Volvo.

That's why the Swede welcomes the FIA's direct involvement, suggesting it will benefit both ends of the mixed-surface discipline's spectrum.

"We need to have the grassroots, the cross-cars, the youngsters dreaming about being in rallycross," he said. "To do that, the dream of a very good world championship needs to be there.

"Everyone dreams about being there one day, and perhaps being a professional driver. Then we'll have what we had, 2016, '17, '18 [referencing one of the sport's golden eras], when we had a lot more interest from younger people coming into rallycross, because they had a belief that one day they can sit in the world championship like they do in WRC or Formula 1.

"The dream needs to be there. It's no top without the bottom, or the opposite. So we need all routes to work, but definitely the full grid and world championship with good races can benefit all." RT

RIGHT Hansen believes the new deal can lead the sport out of the wilderness

LEFT Richards had concerns "about the erosion of accountability and good governance within the FIA"

"Gagging order" protest against FIA president

THE pressure on under-fire FIA president Mohammed Ben Sulayem ramped up when David Richards, the chairman of the UK's governing body for motorsport, threatened the FIA with legal action.

Richards backed Ben Sulayem during his election campaign in 2021, even in preference to the British candidate, Graham Stoker. But the FIA president been embroiled in a number of controversies since he succeeded Jean Todt. He made a number of enemies with his approach to F1, but also changes to the statutes reducing accountability, the departure of a number of senior figures and rule changes trying to control drivers' behaviour.

Richards admitted to having become "increasingly worried" over such events. He said that for him the "final straw" had come when, along with several other members, he was barred from attending a World Motor Sport Council meeting for failing to sign an additional confidentiality agreement that he regarded as tantamount to "a gagging order".

Richards said such a move "was in total breach of the FIA Statutes that require all elected members be given full access to meetings."

In an open message to Motorsport UK membership, Richards said there has been "a distinct failure" to deliver the three pillars that encouraged him to back Ben Sulayem originally – namely hands-off leadership, the appointment of an empowered and capable CEO, and full transparency of actions. He added: "The situation has progressively worsened with media reports confirming that numerous senior members of the FIA and volunteer officials have either been fired or have resigned under an opaque cloud.

"Furthermore, the scope of the Audit and Ethics Committees has been severely limited and now lacks autonomy from the authority of the President, while our UK representative, who challenged certain matters, was summarily removed along with the Chair of the Audit Committee.

"Various techniques have also been deployed with the effect of limiting the proper function of the World Motor Sport Council, primarily the use of e-voting which removes the opportunity for much needed discussion and debate on key subjects."

Having already signed a confidentiality agreement to be part of the WMSC in 2021, and being bound by the FIA Code of Ethics, Richards said he regarded the latest confidentiality agreement as a gagging order.

He revealed, "The key clauses I objected to were:

• Everything was now considered confidential, without any qualification, preventing me from necessarily sharing what I considered to be relevant information.

• The FIA, at its own discretion, could decide if anyone breached the terms of the new confidentiality agreement with no process or frame of reference.

• There was an immediate fine of €50,000 for any breach and a threat of undisclosed damages.

"The construction of this new confidentiality agreement does not comply with the Statutes of the FIA and contradicts the promise of transparent governance we had voted for."

Richards — who says he understands the need to keep certain topics confidential — claims he was told he would be barred from the WMSC meeting if he did not sign the agreement and was denied a request to have the matter be debated at that meeting.

Having been barred, Motorsport UK lawyers and their French legal counsel challenged the FIA on its actions, but says no response was received. As a result, Richards published his message and threatened to take the matter further.

"Integrity is a core value of Motorsport UK and one that is central to who we are," Richards wrote. "Our Board and Executive Team will always operate in an open and transparent manner so that our members trust and respect our voice. We are fully aligned with Sport England and UK Sport's Code for Governance which sets out gold-standard levels of transparency, accountability and integrity in sports governance.

"It's therefore beholden on us to demand the same values of our governing body, the FIA. These actions by the FIA are in breach of their own Statutes. As a result, we have informed the FIA that unless they address the issues we've raised, we will be engaging in further legal action.

"In a year when the President will either be re-elected or a new one appointed, it is more important than ever to remind the FIA of their responsibilities and continue to hold them to account on behalf of the sport and their members worldwide, and that's what I intend to do."

In the build-up to the next FIA presidential election it is telling that Richards, one of Ben Sulayem's supporters, should have been provoked into becoming a potential rival.

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Merc reveals ambitious first steps towards sustainable carbon fibre composites in F1

THE Mercedes-AMG PETRONAS F1 Team is taking its first steps on the difficult road towards sustainable carbon fibre composites.

F1's initial pioneering efforts to master carbon fibre composites were a source of great pride. However, the technology's use now presents a significant sustainability challenge due to its energy-intensive production, difficulty in recycling, and the resulting waste.

Carbon fibre composites form approximately 75% of this season's Mercedes W16 racecar. They are primarily formed of two key components: the fibres and the resin system. By weight, approximately 60% of the composite material is formed of fibres, with 40% made up by the resin system. To achieve a sustainable carbon fibre composite, both components – the fibres and the resin system – must be addressed.

The team has two separate projects underway for introduction later this year, one of which will address the resin system and one the carbon fibres themselves.

Mercedes hopes these pioneering sustainable materials projects will offer the opportunity to scale this innovation beyond motorsport.

"When you combine performance and innovation, you create progress. I am proud to lead a team of problem solvers who are committed to driving sustainable change," commented team principal Toto Wolff. "I would like to thank our partners for supporting our drive for material innovation, and to the FIA for enabling us to test these materials.

"Collectively we are moving the dial on sustainable products and demonstrating that Formula 1 continues to be the fastest laboratory in the world."

"Our team's efforts in this space are the latest demonstration of our ambition to become one of the world's most sustainable global sports teams," added Alice Ashpitel, the squad's head of sustainability.

With each carbon fibre component involving four to eight suppliers to deliver the final product, the team has worked closely with its supply chain on this issue. It has leveraged its close ties with Principal Partner INEOS and its collaboration with fibre manufacturer Toray, fabric weaver Sigmatex and resin formulator and prepreger Syensqo. RT

BELOW Three-quarters of the W16 relies on carbon fibre composite technology

Williams strikes another major deal

ATLASSIAN Williams Racing has entered a major multi-year partnership with Brillio, the global technology consulting and service company.

The US-headquartered company becomes the team's Official Digital Transformation Partner. Williams is seeking to leverage s its new partner's expertise in data, AI, platform engineering, cloud and infrastructure services.

Beyond the ambition of Williams to return to the sharp end of the F1 field, the partnership will also look to leave a legacy by elevating Brillio's global Corporate Social Responsibility initiative, Bringing Smiles, which is focused on fostering STEM education and career development among underserved children to prepare them for a digital-first and disruptive world. STEM education is also a major focus for Atlassian Williams Racing, which runs a schools outreach programme that will bring more than 10,000 8- to 15-year-olds to its Grove HQ free of charge this year to introduce them to careers in science, technology, engineering and maths through the lens of motorsport.

Ahead of the 2025 season Williams also announced new partnerships with Santander, Super Group and Reviva and extended partnerships with Duracell, Gulf Oil International and Kraken.

James Vowles, Team Principal, Atlassian Williams Racing, said: "Brillio's expertise in harnessing cutting-edge technologies to unleash potential and performance align perfectly with our vision for the future as we transform in all areas to return to winning ways. Brillio joins a growing roster of major global companies who believe in our destination and want to contribute on our journey."

Raj Mamodia, Founder & CEO of Brillio, commented: "We believe high-performance engineering, data and AI are the keys to unlocking the next era of motorsport excellence. Our partnership goes beyond technology, it's about a relentless challenger mindset to push boundaries." RT

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TotalEnergies steps into WRC breach as P1 Fuels enters administration

ENERGY giant TotalEnergies has been appointed the new single supplier of sustainable fuel to the FIA World Rally Championship. The decision was taken by the Fédération Internationale de l'Automobile (FIA) after the WRC's existing supplier, P1 Performance Fuels GmbH, entered administration.

The WRC became the first FIA World Championship to introduce 100% sustainable fuel in 2022, when P1 supplied a fossil-free, hydrocarbon-based fuel. Featuring a blend of synthetic and bio-fuel components, it delivered CO2 reductions of around 80 per cent.

P1 Performance Fuels GmbH billed itself as 'A German company with a global mission'. Along with high-profile demonstrations in historic motorsport with the likes of Sebastian Vettel, it had signed a deal to supply the DTM, was involved in karting and had also begun supplying its fossil-free fuels to consumers.

ABOVE The WRC was the first FIA World Championship to switch to sustainable fuel

P1's ambition was to build an industrial-scale plant for e-fuel production, which Martin Popilka – its CEO and founder – believes could bring the technology close to price parity with fossil fuels. P1 was already working on the design of a pilot plant in Germany. However, the company has now been placed into provisional insolvency administration by Charlottenburg District Court. Restructuring firm Greenberg Traurig has been appointed as its administrator.

The sustainable fuel for the WRC was already in transit to last month's Safari Rally Kenya when the crisis erupted. The company's financial problems halted the fuel at customs but the FIA intervened, working with logistics entities to ensure it was delivered and distributed for use during the event.

The governing body then worked quickly to reach agreement with TotalEnergies – which already provides sustainable fuel for the FIA World Endurance Championship and FIA European Truck Racing Championship – to secure a stable supply for the remainder of the season.

The tender for the single supply of sustainable fuel to the FIA World Rally Championship for 2026-2028 has recently closed and the FIA is assessing the submissions received.

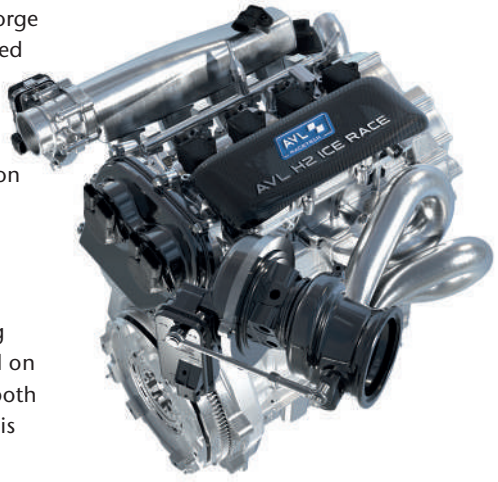
FIA Junior Road Sport Director, Emilia Abel, said: "It is never an easy situation when a supplier enters administration, but we have been able to react effectively to ensure there has been no negative impact on the competition." RT

AVL RACETECH and RAVENOL sign deal for H2 combustion development

AVL RACETECH and RAVENOL are to forge a technical alliance focused on advanced hydrogen combustion technology for sustainable racing applications.

At the heart of this collaboration is AVL's pioneering hydrogen combustion engine that was first showcased in 2-litre turbo guise, with intelligent water injection, two years ago. The belief is that RAVENOL's expertise – particularly its experience developing the Racing ECO lubricating oils based on renewable raw materials – will help both companies push the boundaries in this emerging area.

Their development teams have been co-operating in working groups for the past year, but the new deal offers a formal framework for continued development of the environmentally friendly technologies necessary to take alternative powertrains to the next level.



ABOVE The deal will help take AVL RACETECH's hydrogen-powered 2-litre turbo to the next level

Dr Paul Kapus, Manager Spark Ignited Engines at AVL List GmbH, commented: "We believe that even at 150 kW/l we have not reached the limits for specific power of hydrogen engines. The cooperation will help us to push limits further."

Dr Markus Karsch, Head of Product Development at RAVENOL, said: "The technical partnership with AVL RACETECH in the field of innovative oils for hydrogen combustion engines aims to develop high-performance lubricants that maximize the efficiency and longevity of this pioneering drive technology." RT

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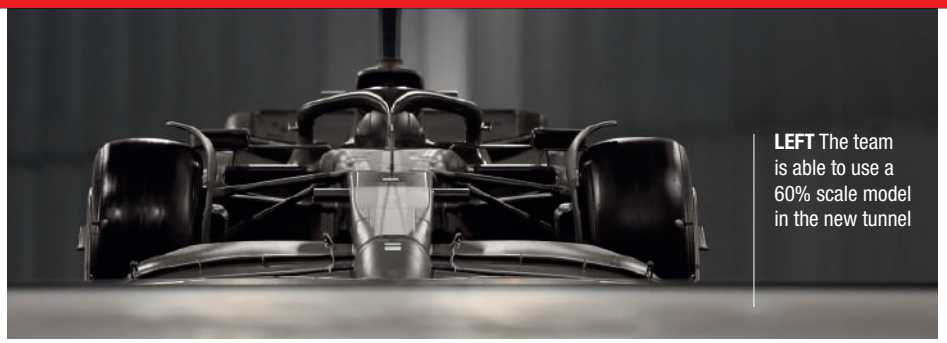

LEFT The team is able to use a 60% scale model in the new tunnel

Aston's new wind tunnel up and running

THE Aston Martin Aramco Formula One Team might be braced for a difficult 2025 campaign but, behind the scenes, the squad has passed a significant milestone it hopes will aid its transition to an F1 world title-challenger.

Its new wind tunnel at the AMR Technology Campus in Silverstone is now in operation. The team's FIA-nominated wind tunnel will be used to support the development of this year's AMR25, alongside a big focus for the 2026 campaign.

The facility is viewed as a vital piece of the puzzle as Aston Martin Aramco transitions to a full works team in 2026.

The wind tunnel is housed in a 60,580m^3 building that also includes the state-of-the-art additive manufacturing machines and model build area for the new, highly sophisticated 60% scale car models. Andy Cowell, CEO and Team Principal, Aston Martin Aramco Formula One Team, said: "Thank you to everyone who has contributed to the creation of our own wind tunnel facility at the AMRTC. The task of bringing together external partners and new in-house technology working hand in glove to such tight deadlines is impressive. The facility provides new technology that enables the aerodynamicists to observe in greater detail the complex flow physics of an F1 car. To have everything here under one roof is extremely beneficial for us as we work towards being a fully operational works team from 2026."

Bcomp and Tras join forces to bring bio-based technologies to motorcycle racing

SWISS sustainability pioneer Bcomp is collaborating with Tras, a leading Japanese composite specialist, on new racing bike designs.

The two companies have worked together before in the luxury furniture and motorsports sectors, but this marks their first venture into the racing bike industry as collaborators. Their ambitious aim is, they say, to redefine the future of motorbike racing.

Tras has been making the bodywork of Suzuki's MotoGP bikes for over 20 years, including manufacturing the full body of Suzuki's winning machine GSX-RR. This demo machine featured a natural fibre cowl made using Bcomp's cutting-edge materials.

The latter's flax-based ampliTex and powerRibs composites offer a sustainable alternative to pure carbon parts – with up to 85% CO2 footprint reduction and viable end-of-life solutions – while also improving safety by reducing debris on track, due to the ductile fracture behaviour of these fabrics.

Most recently, Tras and Bcomp collaborated on the SUZUKI CN CHALLENGE racing motorbike, used to participate in the FIM World Endurance Championship Suzuka 8 hours race. Tras used Bcomp's materials to create a natural flax fibre body and its flax composites to develop the front and rear fender and winglets of the motorbike.

Team SUZUKI CN (Carbon Neutral) CHALLENGE aims to accelerate sustainable performance solutions by using parts and fuel made from sustainable materials – from tyres that use an increased ratio of recycled materials, to recycled carbon materials parts or Bcomp's natural flax fibre parts.

Natsumi Nitta, General Manager at Tras, commented: "This collaboration has enabled us to push the limits of MotoGP performance while utilising new sustainable technologies. The use of this natural fibre has been a major turning point which is changing the status quo of the motorcycle racing and the motorsports industry more widely. Ultimately, this collaboration isn't just about playing a role in winning races. It's about accelerating progress across the two-wheeled world, ensuring that the breakthroughs seen on the track today will shape the motorcycles of tomorrow."

ABOVE Bcomp has teamed up with leading Japanese composite specialist, Tras

Johann Wacht, Manager Business Development & Strategic Customer Relationships at Bcomp, added: "Teaming up with Tras' industry-leading composite experts has enabled us to demonstrate that ampliTex and powerRibs can push the limits of MotoGP, in performance as well as sustainability. With race organisers increasingly demanding more sustainable alternatives, our collaboration showcases how bio-based materials can be seamlessly integrated into part manufacturing and vehicle design, offering a glimpse into the future of sustainable motorsports."

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Maserati breaks autonomous world speed record with AI driver

AN AI-powered and driverless Maserati MC20 has set a new autonomous speed record of 197.7 mph (318 km/h).

The ambitious project saw the Indy Autonomous Challenge (IAC), which is dedicated to advancing autonomous technologies through high-speed racing, join forces with Politecnico di Milano, Italy's largest scientific-technological university.

The run took place at Cape Canaveral's Launch and Landing Facility in Florida, one of the world's longest runways at 15,000 feet (2.8 miles) and the historic location for NASA Space Shuttle landings. The record surpassed the previously held absolute record for an autonomous car of 192.8 mph, set by IAC and PoliMOVE at the same location in April 2022 with an IAC AV-21 racecar.

ABOVE The driverless Maserati MC20 Coupé reached 197.7 mph

The achievement is said to represent a huge leap forward in high-speed autonomous driving development, showcasing how the learnings of high-speed autonomous racing can transfer to streetcars.

"These world speed records are much more than just a showcase of future technology; we are pushing AI-driver software and robotics hardware to the absolute edge. Doing so with a streetcar is helping transition the learnings of autonomous racing to enable safe, secure, sustainable, high-speed autonomous mobility on highways," said Paul Mitchell, CEO of Indy Autonomous Challenge and Aidoptation BV.

The Maserati previously held the record for the fastest autonomous production car, reaching 285 km/h (177 mph) at the Piacenza Military Airport track in November 2024.

"The goal of high-speed tests is to evaluate the behaviour of robo-drivers in extreme conditions. These AI systems have been tested in production vehicles at legal road speeds in the Indy Autonomous Challenge races since 2021. Conducted in controlled environments without a human driver, the test assesses the AI's stability, robustness, and reaction time, ultimately enhancing safety for low-speed urban mobility situations," explained the Scientific Director of the project and Director of the Department of Electronics, Information, and Bioengineering at the Politecnico di Milano, Prof Sergio Matteo Savaresi.

In February the Indy Autonomous Challenge established a commercial spin-off company, Aidoptation BV, headquartered at Droneport in Sint-Truiden, Belgium. Aidoptation seeks to transition the learnings and technology of IAC's autonomous racing programme to advance autonomous mobility on highways. RT

Porsche acquires VARTA AG

PORSCHE AG has strengthened its position in the development and production of ultra-high-performance lithium-ion cylindrical cells.

The manufacturer has acquired V4Drive GmbH from the VARTA AG Group. VARTA AG will retain a minority stake without any operational influence.

V4Drive is being rebranded as V4Smart, a move intended to emphasize that the potential applications of the high-performance cells extend well beyond the automotive sector.

Cells from V4Smart have already made their way into series production at Porsche as booster cells in the 911 GTS models, raising the driving performance of the iconic sports car to a new level.

Production of these cells currently takes place at the Ellwangen site, which has already been brought to series-production readiness with significant input from Porsche. From now on, the cylindrical cells will also be manufactured in a new facility at the Nördlingen site.

ABOVE The acquisition means V4Drive becomes V4Smart

"The booster cells enable us to bring motorsport technology to our production cars," said Albrecht Reimold, Member of the Executive Board for Production and Logistics at Porsche AG.

"Thanks to the strategic partnership with V4Smart GmbH, Porsche is now able to offer customers the entire process chain for cylindrical cells – from cell chemistry and cell design to the finished cell or complete production plant." RT

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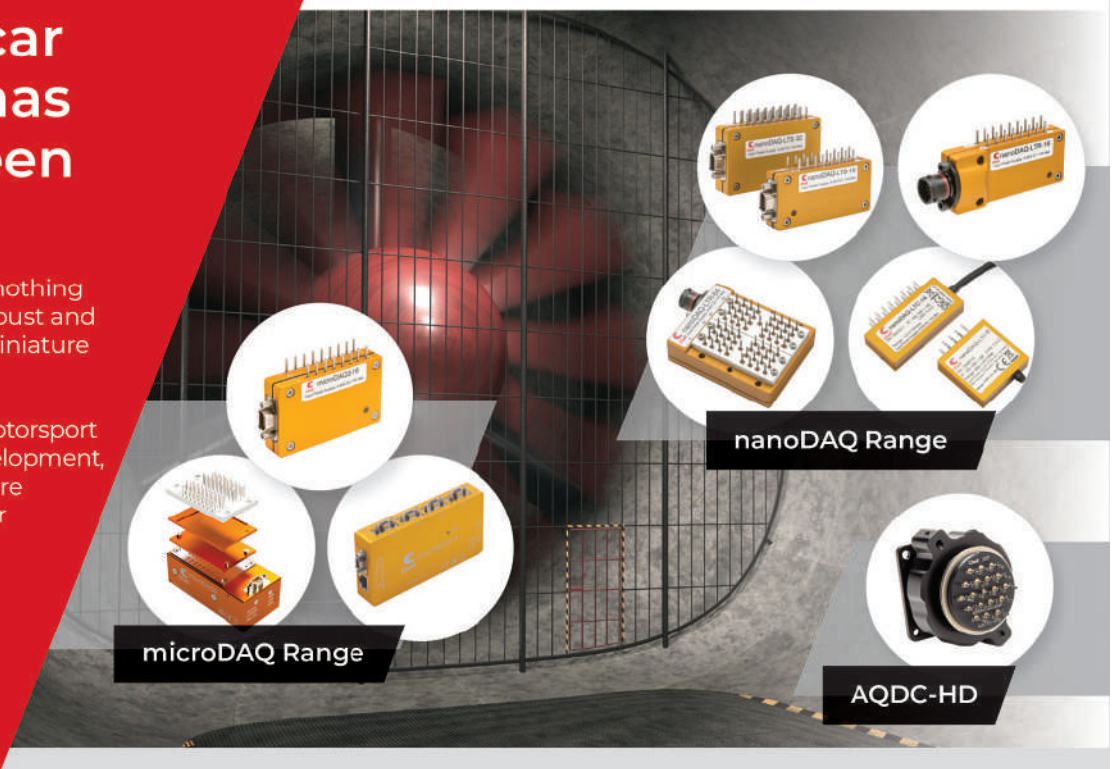

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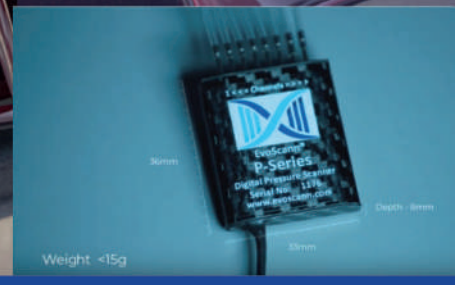

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Engine gives Genesis WEC project a headstart

HYUNDAI'S World Rally Championship-winning engine has given the Genesis brand a flying start to its endurance racing programme.

"The biggest challenge is the time we have available," said Team Principal Cyril Abiteboul of the plans to compete in the FIA World Endurance Championship (WEC) in 2026 and the IMSA SportsCar Championship (IMSA) in 2027. "We need to have a group of 60 people who do not yet exist.

"Another big challenge, from a timing and engineering perspective, is the powertrain. And anyone who knows about engines will appreciate that we only had six months to develop a complete engine. We elected to go with a V8, precisely because the V8 was a great opportunity not to have to redesign a complete engine from scratch and instead take inspiration from our [Hyundai Motor Group's] existing WRC engine, a very competitive 1.6-litre turbocharged inline-four that we've been using for several years.

"We took that engine and made it two times four in line, which gives us a V8."

The Genesis GMR-001 Hypercar will use the spine of the ORECA LMP2 chassis for its entry to the LMDh ranks.

"It's not just a car that we need to build," suggested Abiteboul. "It's a racing team. An organization. A new identity.

"We're not just trying to build the here and now, but also a legacy. Racing in this type of championship against legacy brands allows us to immediately connect the brand with the best of the best in the most iconic racing venues in the world." RT

BELOW The full-size GMR-001 Hypercar will soon be revealed

Taycan sets lap record for electric cars at Interlagos

AFTER setting records all the way from the Nürburgring Nordschleife to the WeatherTech Raceway Laguna Seca in California, the Taycan Turbo GT with Weissach package has now also set a lap record for electric cars at Interlagos, São Paulo.

The new lap time of 1:42.1 minutes not only scythed almost eight seconds off the record set by the Taycan Turbo S in 2022 (1:49.8 minutes) but was also just under a second inside an earlier time set by the 911 Turbo S (1:43.087 minutes).

"I expected the strong acceleration and torque but, ultimately, it was the overall performance that really impressed me," said Porsche works driver Felipe Nasr, who set the mark, just in time for the debut of the Taycan model series on the Brazilian market.

"It's amazing how quickly the car accelerates and delivers its power.

"The steering was very precise in the slow corners and remained stable even under heavy braking. The balance, the grip – a real performance machine," he said.

Porsche has rounded off the top end of its lineup of all-electric sports sedans with the Taycan Turbo GT and the Taycan Turbo GT with Weissach package. A more powerful and more efficient pulse inverter with silicon carbide as the semiconductor material is used on the rear axle of the latter.

Both cars achieve a limited-time peak power output of up to 1019 hp. At the push of a button, Attack Mode provides a power increase of up to 160 hp for up to 10 seconds. The system has been optimized for use on track and is similar in function to that of the 99X racing cars that Porsche uses in the ABB FIA Formula E World Championship. RT

LEFT It's the fourth time, on the fourth continent, that Porsche has secured a lap record with the electric sports car

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Torque sensors to feature at Macau

THE FIA is widening its rollout of the use of torque sensors in sportscar racing, introducing them for the first time to the FIA GT World Cup, which is traditionally part of the prestigious Macau Grand Prix.

Torque sensors offer very high accuracy in measuring power, allowing the FIA to ensure that the power of each car does not exceed the Balance of Performance-allocated values. The information is also used to ensure that external factors like atmospheric conditions do not influence performance. The sensors are installed on the driveshafts of the cars and are the most effective tool to measure power at the wheel, allocated individually by the BoP process to each car model.

The decision to mandate torque sensors followed consultations with the manufacturers involved in the GT3 Technical Working Group. Torque sensors are now mandatory in the FIA World Endurance Championship's Hypercar and LMGT3 classes, as well as in the ABB FIA Formula E World Championship and the FIA World Rally-Raid Championship's Ultimate class.

Lutz Leif Linden, FIA GT Commission Chairman, said: "Improved control of BoP values is particularly important on a circuit as demanding as the one in Macau, where high-speed straights contrast with tight, narrowing corners."

Fabrice van Ertvelde, FIA Technical Circuit Sport Manager, said: "The implementation of torque sensors is a very effective tool, allowing us to realign all the very different cars on parameters such as pure power but also on top speed, which is a crucial factor on a track such as the Guia Circuit." RT

BELOW Torque sensors will be used for Macau's blue ribband event

Shell and BMW M Motorsport renew partnership

SHELL and BMW M Motorsport have signed a renewal of their longstanding partnership, carrying their alliance into a second decade.

Shell will continue to support the German squad's factory racing programmes in the World Endurance Championship and in IMSA. The two will also collaborate on GT3 activities.

BMW M Motorsport exclusively uses and promotes Shell products such as Shell Helix and Shell EV Plus. The most obvious manifestation of the deal on the racetrack will be the return of the spectacular Shell livery to the WEC and Le Mans 24 Hours, with the #20 Shell BMW M Hybrid V8 adorned in its iconic colours from the FIA WEC season-opener in Qatar onwards.

The two companies are working on joint future projects. These include more sustainable lubricants, e-fluids for electric vehicles, and innovative fuel and energy concepts for motorsport projects.

"Without strong partners like Shell, engagements by BMW M in series production and BMW M Motorsport in racing are unthinkable," said Franciscus van Meel, CEO of BMW M GmbH. "The fact that we can look back on 10 years of collaboration is extraordinary – and I am very pleased that we are now reaching the next level together. In addition to close collaboration within our current racing programmes, the development of new future technologies in both the racing and series production sectors is crucial.

"As mobility and thus the entire automotive industry are changing rapidly, it requires partners who share our pursuit of innovation and perfection. This is absolutely the case with Shell." RT

ABOVE The iconic Shell livery once more adorns a top car in elite endurance racing

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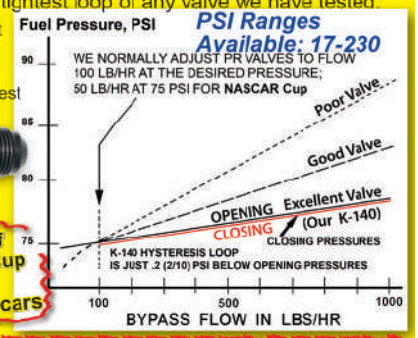

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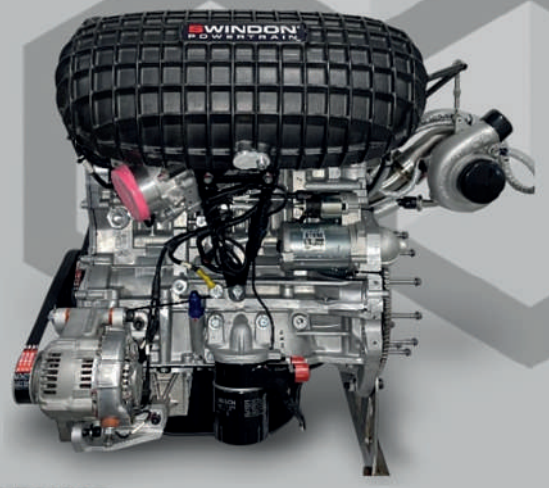

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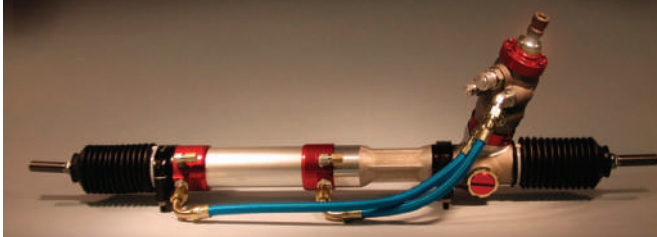

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FIA Seat Attenuator setting new standards in W2RC safety

THE 2025 FIA World Rally-Raid Championship features a significant leap forward in crew safety following the first implementation of the new Seat Attenuator. Run in the new Dacia Sandriders, it was the first such device developed in accordance with FIA safety regulations.

Mandated in new T1+ vehicles in the W2RC from 2027, the new safety regulation has been developed by the FIA with funding support from the FIA Foundation. It is designed to protect crew from spinal compression injuries which may be caused by a heavy landing from a jump by suspending the seats inside the car with a specialised damper that absorbs the energy from an impact.

Using real-world data from incidents involving a heavy landing, experts defined a representative 'severe crash pulse' as a target for the project to mitigate against – a 40g peak crash pulse orientated at an angle of 58 degrees from the horizontal axis.

This crash pulse was then used in simulations to define the best force displacement characteristics for the seats installed in the competition cars, so that a dampening mechanism could then be developed and connected to the seats.

Following refinement through simulations, an optimal design for the impact dampener was manufactured and underwent laboratory testing.

The FIA supported Prodrive to develop a suspended seat, connected to the roll cage via the specified damper. This was first implemented successfully on the 2024 Rallye du Maroc.

FIA Head of Research and Vehicle Safety, Marco Petrilli, said: "This has been a really fantastic project to bring to the W2RC. We are driven by the data, and we identified this as an area that we could bring some significant benefits for the crews. Using the FIA World Accident Database, we could define what a typical 'high-impact' landing that can cause a spinal injury looks like, and use that information to set our targets for the seat attenuator, and then set requirements for a device according to our extensive simulations. It's a great example of how the FIA is always working to improve safety."

ABOVE The impact damper can provide 50% better protection against spinal injury

DS Penske Formula E team introduces multi-sim programme

ANSIBLE MOTION, a leading manufacturer of Driver-in-the-Loop (DIL) simulators, has expanded its partnership with Penske Autosport with the delivery of four new Theta Seat Sport simulators.

Following its acquisition of Ansible's Delta S3 DIL simulator last year, the racing team now has a multi-sim testing and development centre.

This new five-simulator setup enables the driver of the existing Delta S3 simulator at DS Penske – featuring full dynamics, 48K image rendering, a full 360° wrap-around screen and real Formula E cockpit – to interact virtually in real-time on-track with four drivers in separate Theta Seat Sport simulators.

The multi-sim could potentially improve preparation for Formula E's Peloton-style races, where drivers jockey for position while conserving energy. The new setup is enabled by software from AVL RACETECH – a long-time technical partner of Ansible Motion – with its vehicle modelling network, providing unified multi-simulator connectivity.

"DS Penske's multi-simulator solution enables the customer to simulate highly realistic race scenarios including traffic, thus creating a unique testing environment for the development of race car setups and energy management strategies," commented Guillermo Pezzetto, global sales & business development manager racing at AVL RACETECH. "To maximize the benefits of this setup, the vehicle dynamics simulation used must be capable of realistically modelling the physical effects of running in traffic, which is exactly what our AVL VSM RACE software is doing."

SIMULATION BREAKTHROUGH
Page 62

Driving Technology Into Pole Position

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F1 pays tribute to Eddie Jordan

BELOW Aston Martin raced with a shamrock logo on its AMR25

TRIBUTES poured in following the death of former team owner and pundit Eddie Jordan.

The founder of the Jordan Grand Prix team passed away in Cape Town at the age of 76, following a battle with an aggressive form of prostate cancer. Jordan's eponymous team entered 250 grands prix and took four victories – with a best finish of third place in the drivers' and constructors' championship – before he sold it in 2005.

Although Jordan is widely remembered for handing Michael Schumacher his F1 debut, at Spa in 1991, he was instrumental in giving a chance to many young talents, including Martin Brundle, Johnny Herbert, Eddie Irvine and Jean Alesi.

Brundle recalled that between them, he and Jordan "barely had a pound in our pocket" the year he famously battled Ayrton Senna for the British F3 crown at the wheel of Jordan's cars.

Irrepressible

"He was irrepressible," said Brundle, who would later return to the Jordan ranks in F1. "What a character. What a rock star. What a racer. So many drivers owed him so much. He gave us our chances and believed in us.

"Everybody loved him. The sport will be poorer without him for what he achieved, what he stood for, what a racer he was."

Red Bull team principal Christian Horner said: "Eddie was a hugely colourful character who I first met in 1991 as a young driver at his then new factory after his first year in Formula 1. His advice, 'get a good sponsor... welcome to the Piranha Club!'

"I was fortunate to overlap with him when I came into Formula 1. He was in the twilight of his F1 career race wise (indeed he even tried to sell me his team!) but went into other media activities where he was always full of

energy and fun to work with. Formula 1 has lost a legend and we will miss his wit and his Irish charm."

The lineage of Jordan's F1 operation can be traced through to the current Aston Martin squad. In Shanghai, the team paid tribute by adding a shamrock decal to the AMR25 with Jordan's name underneath, a nod to the original team's logo from the 1991 season.

Current Aston Martin team principal Andy Cowell described Jordan as "one of the all-time motorsport greats," who had established an independent team without the backing of a major manufacturer back in the early 1990s.

"He was a one-off, a wonderful human being, and a charismatic leader who founded this team and took it to F1 in 1991," Cowell said. "His vision laid the foundations for us and he leaves a lasting legacy for the entire motorsport community."

First FIA-approved Cross Car takes centre stage at Safari Rally

THE FIA Affordable Cross Car made a landmark appearance on the opening day of Safari Rally Kenya in Nairobi last month.

The FIA Affordable Cross Car project is a key initiative in the FIA's mission to grow motorsport at the grassroots level. The governing body for world motorsport sees cross car serving as an entry point in the pathway to the World Rally Championship (WRC), World Rally-Raid Championship (W2RC), and World Rallycross Championship (World RX).

The vehicle was presented by His Excellency President William Ruto at the ceremonial start. Fourteen-year-old Kenyan driver Cheche Ababu then took the wheel for a televised demonstration run ahead of the Kasarani Super Special Stage, showcasing the vehicle's potential to grow grassroots motorsport in Africa.

Built in just one month by students at the IPRC Polytechnic school Kigali, the cross car showcased in Nairobi was developed using FIA design blueprints and is a cost-effective, locally manufactured solution, with a target price of $5,000.

"When I was elected as FIA President, I made a commitment to doubling participation in global motorsport and achieving that goal requires tackling accessibility head-on," said FIA President Mohammed Ben Sulayem. "The launch of the programme has created a vital entry point into off-road racing, offering the next generation of talent a pathway to compete and ensuring broader worldwide participation."

"The FIA Affordable Cross Car is a game-changer for Kenyan youth, providing them with a crucial entry point into motorsport," said Maina Muturi, Chairman of the Kenya Motor Sports Federation (KMSF). "Motorsport's future lies with young talent, and this project lays the foundation for tomorrow's WRC stars.

"We will collaborate with the government, local sports academies, and county programmes to expand this initiative across Kenya, ensuring accessibility for aspiring drivers nationwide. We're delighted to plant this seed together with the FIA for a bright motorsport future."

Rwanda plans to produce 50 vehicles in the next three years, including exports to the region.

BELOW Could the FIA Cross Car concept reshape entry-level motorsport?

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PASCAL VASSELON
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"The WMS has become a yearly 'Must Attend' event. The now-usual presence of many motorsport leaders, and especially of the governing bodies, make the discussions go beyond just interest: they can really influence the future of our sport. It is now more important than ever to call upon the brightest minds there to design a path toward the necessary energy transition. Long life to the WMS!"

MARK SIBLA
Vice President and Chief of Staff, IndyCar

"Each year, the World Motorsport Symposium brings together a distinguished group of racing experts, each of which is an impactful leader in their field. Their knowledge, insight and transparency on the critical challenges and vision of motorsport make this event essential for industry professionals."

BERNARD NICLOT
ACO's Mission H24 Innovation Director

"The Automotive World is, with each passing year, more and more difficult to predict. The target is well known: Zero CO2; but the way to achieve it on a large scale is dramatically challenging. In such a period, the World Motorsport Symposium, being so open-minded, is very valuable to share and challenge ideas and solutions not just for motorsport, but for motorsport as a lab for future road mobility."

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WHAT THEY SAID...

DR VALERIA LORETI
Delivery Manager Motorsport, Fuels Technology Group, Shell Global Solutions (Deutschland) GmbH

"Participating in WMS 2024 was not only a great opportunity to hear directly from technical experts on a number of relevant and stimulating topics, but also the opportunity for networking and establishing those key relationships that are the basis for further development and exciting breakthrough steps."

DAVID SALTERS
President of Honda Racing Corporation USA (HRC US)

"I really appreciate the effort that goes into the Symposium, the straightforward open discussion, informed debate and reflection."

ERIC JACUZZI
Vice President, Vehicle Performance at NASCAR

"Another great learning experience for the two of us that attended from NASCAR. The topics were very relevant to the future of motorsport, and challenged us to look deeper into some areas of development that we had not previously considered or perhaps considered seriously enough. As always, the collegial atmosphere and lively debates and conversations make for a great event. I am looking forward to seeing everyone again next year and hearing about the advancements another year brings."

ULRICH BARETZKY
Former Director, Audi Motorsport Engine Development, Audi AG

"The 2024 WMS in the famous Royal Automobile Club was very special, a real highlight to mark the event's 20th anniversary. The quality of presentations, as well as the respective discussions in this very special atmosphere, really makes me look forward to the 2025 event."

ALAN PATTERSON
Founder, BeyondMath

"WMS is the one event that brings together all the leaders in motorsport under one roof. As a startup, this is invaluable for us."

SERGE GRISIN
Motorsport Director, Symbio

"I was truly impressed by the quality of the discussions, the insightful exchanges with leading experts in motorsport and technology, the spirit of openness and constructive dialogue, and the overall sense of shaping not only the future of motorsport but also, and more importantly, the future of mobility. A future that aspires to be more sustainable."

LEADING THE CHARGE

BELOW The introduction of Pit Boost showcases the future of fast charging for EV owners

FIA/Formula E

Fortescue Zero's innovative Pit Boost fast charger offers a glimpse into the future not just for racing but for all electric vehicle owners. By **Chris Pickering**

WHY are we here? Motorsport, that is, not humanity in general. That's a bit too existential for these pages.

Entertainment, of course, is part of the answer. But ever since the first automobile manufacturers began to enter motor races in the 1890s, there has been a strong argument that 'racing improves the breed'. Believe it or not, the steering wheel was one of the first innovations to be showcased in motorsport – at a time when most cars still had tillers.

These days the area of technology most in need of a boost from motorsport is electrification. Modern electric vehicles are a relatively recent invention and they're still playing catch up to their combustion-engined counterparts in many people's eyes.

While range figures can win bragging rights among EV owners (or provide ammunition for EV sceptics), the convenience of electric vehicle ownership actually hinges far more on the charging experience. Most of the time, it matters little whether a car can cover 280 miles or 330 miles on a full battery; what can make or break the experience is what happens when you need to plug it in.

This clearly isn't lost on Formula E. The all-electric single-seater championship has proved that it's more than capable of handling a full race distance. And yet Pit Boost recharging stops have been introduced this season. Partly to spice up the strategy, but partly to promote the message that charging an EV doesn't have to be painful.

"Once people get used to driving an EV on the road, they don't actually tend to use fast chargers for a full charge. They tend to add 10 or 20 per cent to top up until they can plug the car in for an extended period at home or at their destination," observes Tim Strafford, Managing Director – Motorsport at Fortescue Zero.

Based in the heart of Motorsport Valley, the green tech company has been channelling competition knowhow into other industries ever since it began as Williams Advanced Engineering in 2010. Racing remains a major part of the business, including the development of the batteries and the Pit Boost chargers for Formula E.

Fast, not furious

It's this concept of a quick stop to add an incremental amount of charge that has driven the development of Pit Boost. The system adds an additional 10 per cent (3.85 kWh) to the battery's energy over the course of 30 seconds during a mandatory pit stop. A single charger is capable of supplying both cars in the team, with capacity to spare.

> *"The messaging behind these 'top up' stops is as important as the technology itself"*

Of course, restricting the top up to 10 per cent limits the duration of each pit stop and helps to keep the fans engaged (at 34 seconds, including connecting and disconnecting the charger, it's roughly half the time of a full fuel stop and tyre change at Le Mans). But Strafford says that the comparison to road-going fast charging was the main reason that this format was chosen.

"When you stop for a fast charge on the road, you want it to be as fast as possible and as ▶

straightforward as possible. So, that's where Pit Boost is absolutely relevant to road technology, and to a lot of the other industries that we're involved in," he comments.

Onboard storage

The basic requirements for energy delivery and pit stop duration were defined by Formula E. When Fortescue picked up the project, its first priority was to look at the form factor of the recharging hardware. Hypothetically, if all 11 teams on the Formula E grid were to bring in one of their cars at the same time and charge at 600 kW, the combined system would need to be able to provide 6.6 MW of power. While this may not be a realistic scenario, it gives some indication of the power levels involved and it quickly became clear that storing the energy with a single containerised solution wasn't going to be practical.

Instead, the decision was taken to go with self-contained units that could be issued to each team as a piece of pit equipment. This dictated certain requirements around the packaging, and it meant that the size and weight of the Pit Boost units had to be manageable to move around the garage.

"Ultimately, there just weren't any self-contained DC fast chargers with onboard energy storage out there on the market, so we knew it would have to be developed as a bespoke solution," notes Strafford.

The onboard energy storage draws from Fortescue's motorsport experience. Just like previous projects in Formula E and Extreme E, the Pit Boost unit uses lithium-ion pouch cells. These are more complicated to package than cylindrical

> *"We were dealing with something that had never been done before"*

cells or prismatic cells, but they offer higher energy densities and better temperature control – both important factors when you're trying to transfer a lot of energy from a lightweight, portable unit.

The next major element inside the Pit Boost unit is a highly efficient DC-DC converter. This uses the same silicon carbide (SiC) technology as you'll find inside the inverters used on a growing number of electric and hybrid vehicles on and off the racetrack. This takes the DC voltage and current at the charging unit and converts that to whatever is required by the battery management system.

"It's not as simple as converting the voltage from one fixed level to another," Strafford points out. "There are a lot of checks that need to be done. The battery cells' ability to receive energy depends on a lot of factors, such as their state of charge and their temperature. One of the jobs of the battery management system (BMS) is to ensure that it's not asking more from the charger than the vehicle battery is comfortably able to accept. In a non-optimal scenario, you could be risking the longevity of the battery or even physically damaging it, so it's something that needs to be managed quite carefully."

RIGHT King Charles, known for his environmental passion, is among those to have taken a close look at the unit

Unusual challenge

Thermal management is also critical. As Strafford explains, a charging unit with onboard energy storage represents quite an unusual challenge: "Vehicle batteries see a continuous power flow once the vehicle is in use, whether the energy is being taken out under acceleration or put back during regen. In either direction, a percentage of that energy is lost as heat, which means that the main thermal management challenge in most cases is

FORTESCUE ZERO
ULTRA-FAST CHARGING TECHNOLOGY
The Fortescue Zero 600kW Ultra-Fast Charger delivers a +10% charge of total battery capacity in under 30 seconds.
DHL

LEFT The decision to produce Pit Boost chargers as self-contained items of pit equipment dictated decisions regarding size and weight – but also entailed the design of a bespoke solution

keeping the battery cool.

"The Pit Boost unit is more complicated in some respects. You don't want it to get too hot if you're somewhere with a high ambient temperature, but most of the time the unit will be sat there dormant, and you don't want the battery to be too cold either. So, in some cases we're actively using this system to warm the battery up rather than cool it down."

With so many different variables at play it falls to the DC-DC converter to ensure that each Pit Boost unit supplies exactly the same amount of energy. To do this, the voltage and current levels are measured very carefully at both ends of the system, with the Pit Boost unit and the vehicle's BMS in constant contact with one another during the charging process.

In theory, developing the Pit Boost unit was simply a question of integrating a series of systems that were already well understood in isolation. As with all engineering projects, however, there have been a series of challenges along the way.

Bottlenecks

"In terms of the use case, we were dealing with something that had never been done before. And when you do that, you tend to unlock a series of bottlenecks as you go through the development," explains Strafford. "The first potential bottleneck was the ability of the grid to supply that much energy in one go, so we resolved that as soon as we selected onboard energy storage. Next you ▶

have bottlenecks in the ability of the cells to accept charge. And that keeps going all the way along – you unlock new challenges at every stage."

Another potential bottleneck is the handshake process that the charging unit and the car must undergo to establish communication at the beginning of the process. In road car chargers – typically designed for a broad range of different vehicle and battery designs – the handshake process can sometimes take the best part of a minute. Pit Boost, on the other hand, only has one type of battery to accommodate, so Fortescue is able to employ a proprietary handshake system that slashes this time to a fraction of a second.

> *"If you know your goal is to add 10 per cent charge as quickly as possible, you can apply a different profile to the one you'd use for a full charge"*

ABOVE Elysia uses a combination of AI, probabilistic statistical methods and physics-based modelling to build up a comprehensive picture of what is happening inside the battery

Myth busting

Strafford hopes that showcasing this quick and convenient form of charging will help to dispel some of the myths around EV ownership.

In some respects, the messaging behind these 'top up' stops is as important as the technology itself, but it's not the only thing that electric motorsport has contributed to real world applications. Strafford points to Fortescue's battery intelligence platform, Elysia, as an example. Developed originally in Formula E, Elysia uses a combination of AI, probabilistic statistical methods and physics-based modelling to build up a comprehensive picture of what exactly is happening inside the battery.

"A traditional BMS system looks at things

like voltages and currents to give it a pretty rudimentary understanding of what's happening inside the cells," comments Strafford. "Elysia, on the other hand, has a physics-based level of understanding. And through that, we can do things like charging at a faster rate than the battery would be comfortable with otherwise. We can do charge profiling. So, if you know that your goal is to add 10 per cent charge as quickly as possible, you can apply a different profile to the one you'd use for a full charge."

These are not just incremental gains. By embedding Elysia's battery intelligence software into BMS systems, Fortescue says it can extend battery life by up to 30 per cent in some cases. This technology has been adopted by Jaguar Land Rover for its road cars, as well as by Fortescue Zero's parent company Fortescue for its heavy mining trucks.

"The mining trucks are electrically-driven. They used to have a large diesel generator onboard to provide energy. Now, we've effectively scaled up the technology used in Pit Boost, with an electric storage unit and a DC-DC converter that controls ▶

FIA/Formula E

RIGHT Pit Boost has added an extra strategic curve ball to the mix

> *"Range figures can win bragging rights but the convenience of EV ownership hinges far more on the charging experience"*

the flow of energy. But it's on a very different scale – instead of 6 kW charging, we're talking about 6 MW that allows us to charge these huge trucks in around 30 minutes," explains Strafford.

Staggering numbers

The numbers are staggering. The haul trucks that Fortescue is currently converting to battery electric propulsion carry a payload of 240 tonnes. The power system for the 7.5-metre long haul trucks weighs >20 tonnes with 2MWh capacity/up to 3MW power output for the first generation. By 2030, the company hopes to be taking away over a billion litres of diesel consumption every year and replacing it with green energy.

"One of the things that we do in motorsport is to really drive the efficiency of the systems," says Strafford. "Translate that across to a mining vehicle and imagine a scenario in which you're throwing away 10 per cent of your energy or more; you effectively need an extra 10 per cent battery capacity. That's more weight, which then impedes your ability to carry useful material within the size of the vehicle, but it also means you're spending more capital expenditure on the expensive batteries in the system

TOP Fortescue has been awarded $A10 million of Australian government funding to develop what will be the most powerful fast charger in the world. The 6MW fast charger for haul trucks will be equipped with robotic connection options

ABOVE The use of improved battery intelligence has the potential to transform other industries. The 240-tonne haul trucks Fortescue Zero deals with are a typical example

as well. If you can optimise the useable capacity or the charging time of the battery without actually changing the hardware, it can dramatically improve the total cost of ownership."

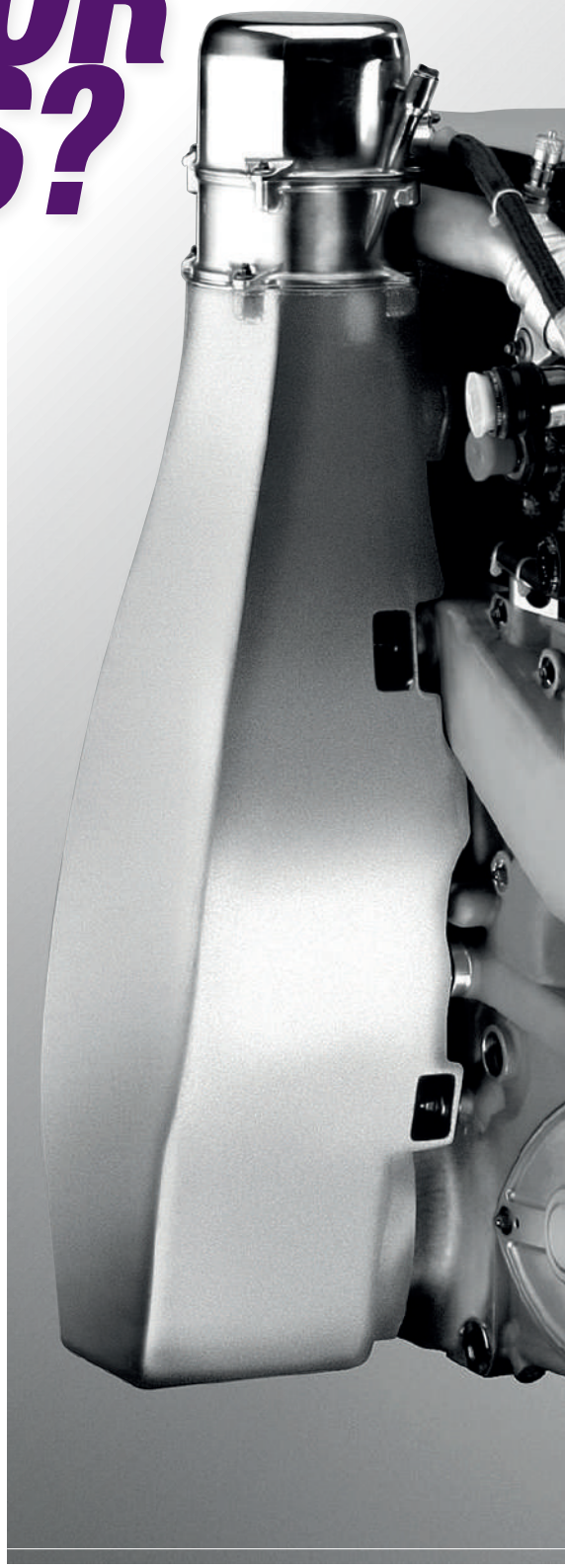
The benefits of improved battery intelligence apply to even larger applications, like stationary energy storage, he explains: "There are some applications where the current level of technology they've got to estimate the state of charge can be subject to an error of plus or minus 20 per cent. So, if you're contracted to give energy to the grid, you basically have to allow 20 per cent headroom, which means you're probably only using 80 per cent of the battery capacity that you've invested in. There are so many synergies between these applications and motorsport."

Racing, it seems, really does improve the breed. And not just when it comes to road cars, but everything from mining trucks to stationary energy storage. RT

BELOW Formula E has always wanted its racing cars to be the banner-bearers for EV motoring. The introduction of Pit Boost brings that relevance into sharper focus

FIA/Formula E

THE V10 VERDICT
ROMANTIC OR RIDICULOUS?



Just months away from the biggest rule changes in F1 history, a controversial return to V10 engines has been suggested. By **Andrew Benson**

MOHAMMED Ben Sulayem has had quite the ride so far as president of motorsport's governing body, the FIA. His tenure has been marked by a series of controversies.

They have included his views on women, rows about driver underwear, jewelry and swearing, the departure of a number of senior people in the organisation around allegations made about his office on the subject of finances, and his decision to change the FIA's statutes to reduce accountability.

He has been accused of interfering with grands prix, and is being sued by Susie Wolff, head of the F1 Academy series for aspiring female racers. The case revolves around a conflict of interest inquiry into her and her husband Toto, the Mercedes F1 boss, which was set up and then abandoned over the course of two manic days.

Ben Sulayem's latest intervention – or at least the latest as this magazine went to print – is on the technical front, over the future of engines in Formula 1.

The sport is less than a year away from doubling down on the turbo hybrids that have been used since 2014. As part of the biggest package of rule changes in history, which also include major modifications to the chassis regulations, the amount of total power produced by the hybrid part of the engine will increase to about 50%, from the approximate 20% currently. In addition to this, fully sustainable fuels will be mandated.

These new rules were decided upon after years of negotiations with car manufacturers, both inside and outside F1, because of the way they parallel the direction of travel in road cars. The Volkswagen Group, which was a central part of the rules negotiations, has responded by entering F1 for the first time, with its Audi brand.

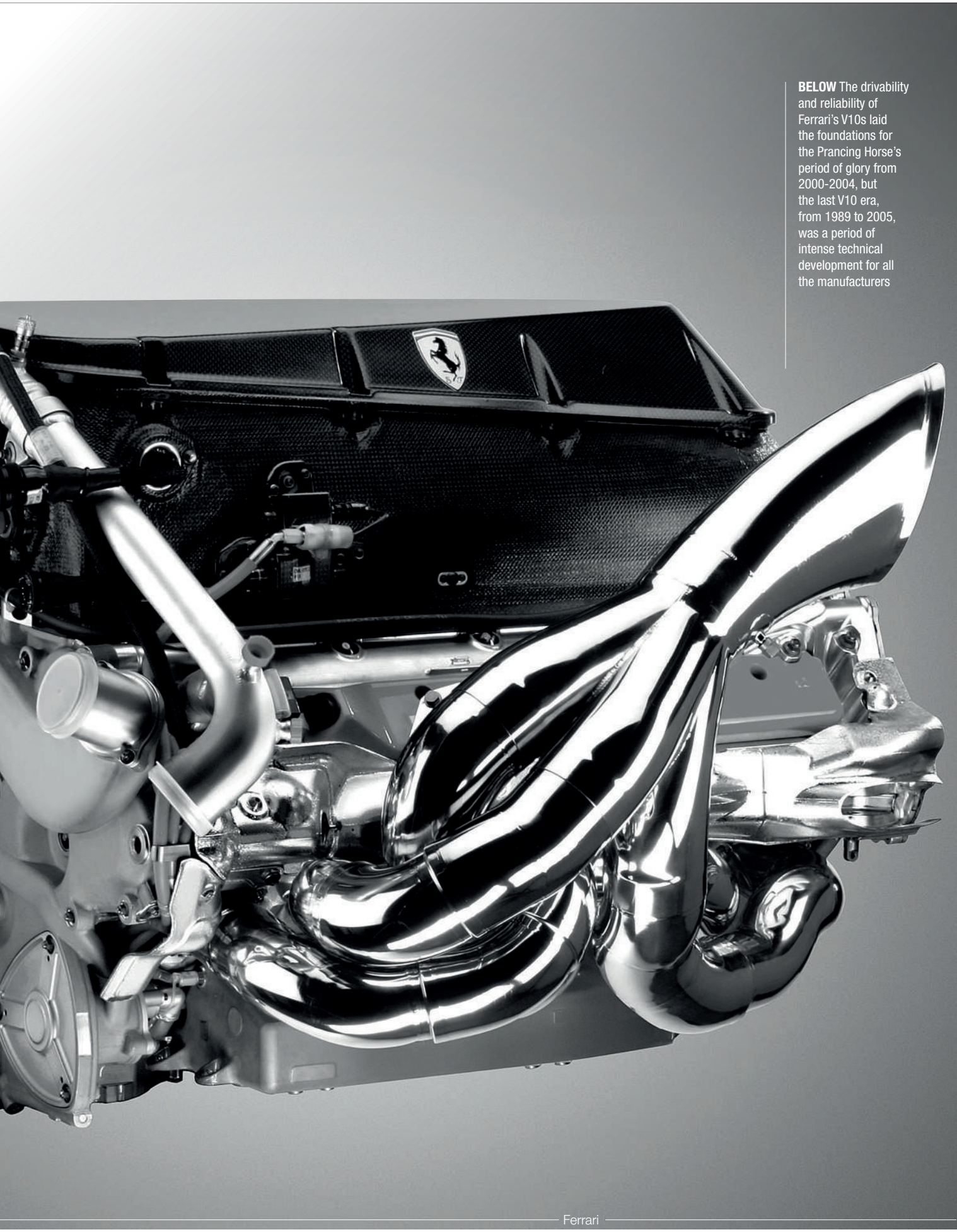
Forefront of technology

Honda, which had decided to quit F1, is staying. Ford has entered and is partnering with Red Bull on its new engine. And General Motors will also come in, setting up a new team under the name of its luxury Cadillac brand.

Ben Sulayem was not FIA president when the rules were being negotiated. But he was in the role by the time they were finally, formally confirmed. And two years ago, he celebrated the achievement.

"The confirmation that there will be six power-unit manufacturers competing in Formula 1 from 2026," he said in an FIA statement, "is testament to the strength of the championship and the robust technical regulations that have been diligently created by the FIA in close collaboration with Formula 1 and the power-unit manufacturers.

"The power-unit is at the forefront of ▶



BELOW The drivability and reliability of Ferrari's V10s laid the foundations for the Prancing Horse's period of glory from 2000-2004, but the last V10 era, from 1989 to 2005, was a period of intense technical development for all the manufacturers

Ferrari

technological innovation, making the future of Formula 1 more sustainable while maintaining the spectacular racing."

And yet less than two years later – and before the new engines have even raced – Ben Sulayem is already suggesting F1 might have a different future.

"While we look forward to the introduction of the 2026 regulations on chassis and power unit," he said in February, two days after the crowd booed when the FIA symbol was displayed at F1's season's launch at the O2 in London, "we must also lead the way on future technological motorsport trends.

"We should consider a range of directions, including the roaring sound of the V10 running on sustainable fuel."

Two days before Ben Sulayem posted this message on Instagram, F1 bosses held a meeting of the F1 Commission, the sport's rule-making body, comprising the FIA, commercial rights holder Liberty Media/F1 and the teams.

It's Bernie on the line...

During that meeting, Red Bull team principal Christian Horner's phone rang. It was former F1 boss Bernie Ecclestone. Horner put the phone on speaker. You should bring back V10s, Ecclestone said.

The topic was not discussed at the meeting, and nor had it had any substantive discussion among this same group by the time of writing. But this certainly led to a bit of a stir in F1 for a while at the start of the season.

Why this should come up now is not so easy to unpick. But undoubtedly in the mix is a degree

Getty Images/Red Bull Content Pool

ABOVE Unanimous support – not something for which the F1 rivals are renowned – would be required for a change of direction with the new powertrains

LEFT F1 has made much of its attracting a younger fanbase (seen here with Liam Lawson). Would they *really* appreciate an ear-splitting V10?

Pirelli

Coryton

LEFT Every F1 team's fuel supplier is hard at work in the laboratory ahead of the 2026 rules upheaval. Some hope the advent of sustainable fuel offers a free pass to revisit old engine architectures

of uneasiness in some quarters about certain aspects of the 2026 engine rules.

This is the first time F1 has changed both chassis and engine rules together for decades, and it was the engines that came first.

The FIA and engine manufacturers wanted a formula that increased the hybrid aspect of the engine but reduced its complexity. That meant doing away with the MGU-H, the unit that recovers energy from the turbocharger, and which is central to the incredible thermal efficiency of the current engines.

F1 engines operate at a thermal efficiency of more than 50% – a quite remarkable figure for an internal combustion engine, which in road cars run at around 29% thermal efficiency.

The problem with the MGU-H was that, despite initial hopes, it proved to have little transferability to road cars, because it relies on an engine that works under maximum load before heavy braking. So its appeal to manufacturers was limited. The complexity of the energy routings in engines with an MGU-H providing support for an MGU-K which recovers energy from and deploys it back to the rear axle, made it not only expensive but fiendishly difficult to master. Which reduced the appeal of F1 for any potential new entrants.

But taking away the MGU-H while increasing the total hybrid performance led to a problem – from where to recover sufficient energy for the bigger battery? Initially, it looked like the cars would need to recover energy from both axles. But that was deemed to be undesirable because of the risks of opening the back door to stability control.

Instead, it was decided to introduce moveable aerodynamics. Front and rear wings will have two settings: one for the corners and one drag-reducing open setting to increase straight line speed, and therefore make braking distances longer.

Even so, the energy recovery requirements of the new engines – which will still have a thermal efficiency in the high-40% region – will mean a change to the driving characteristics of the cars. This is expected to include the need to recover energy earlier in the straights than now.

There were alarmist reports after drivers first tried the new cars on the simulator that they would be changing down a gear on the straights. It remains to be seen whether that comes to pass, but certainly the ICE will be considered more as an energy generator for the battery than is the case now.

Do we need hybrids?

The engines also necessarily remain complex. And the advent of sustainable fuels has made people wonder whether F1 needs to focus so much on hybrids and road relevance.

Red Bull team principal Christian Horner, who was anti-hybrid before his team became Honda's factory engine partner, is one of the prime voices in favour of the idea of returning to a more classic style of internal combustion engine.

Horner says: "We've ended up in a situation where the chassis is having to compensate a huge amount for perhaps some of the shortcomings of the split in electrification and combustion.

> *"For the romantic in you, a screaming V10, so long as it's done responsibly with fully sustainable fuels, is hugely attractive"*

"But, you know, it's sort of 10 past midnight and Cinderella's now left the building.

"So, the romantic in you, a screaming V10, so long as it's done responsibly, ▶

with fully sustainable fuels, is hugely attractive. The big question is: when would that be for? And what would be the gameplan between where we sit today and then? Because it would be a massive departure obviously to move away from what is currently being worked on very hard for 2026."

There is a political aspect to this debate, too. Information about the performance of the 2026 engines is starting to leak out in F1. And the word is that Mercedes has a significant advantage, to the extent that some are even saying that any team

> *"Logistically, I'm not sure how you put the genie back in the bottle"*

that doesn't have a Mercedes won't be able to win next year. No wonder some might be less than averse to the idea of delaying or even abandoning the 2026 rules.

But there is zero possibility of that happening. It would need significant agreement across the teams – and Mercedes, Audi and Honda, at least, would surely never agree.

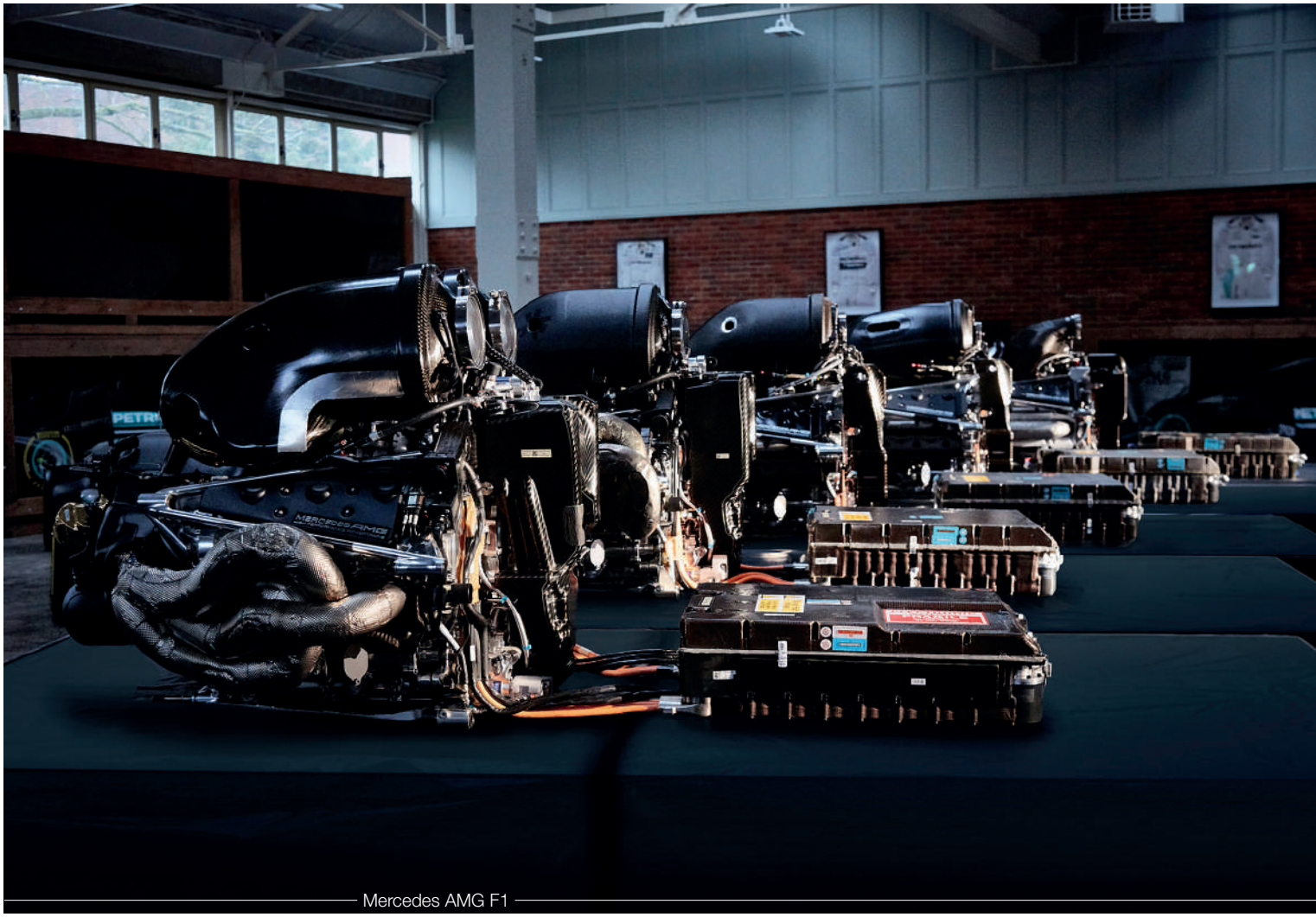
McLaren Racing chief executive officer Zak Brown says: "I don't really see how you can unwind what's in place, really because of all the different power-unit changes that are happening right now.

"Audi's coming in, Alpine's going to Merc for an engine. Logistically, I'm not sure how you put the genie back in the bottle." ▶

Getty Images/Red Bull Content Pool

ABOVE All smiles on the grid, but FIA President Mohammed Ben Sulayem's suggestion of a switch to V10 engines doesn't have everyone laughing

BELOW Mercedes got the leap on rivals at the start of the V6 hybrid era. Are fears of a return to its domination fanning the rumours?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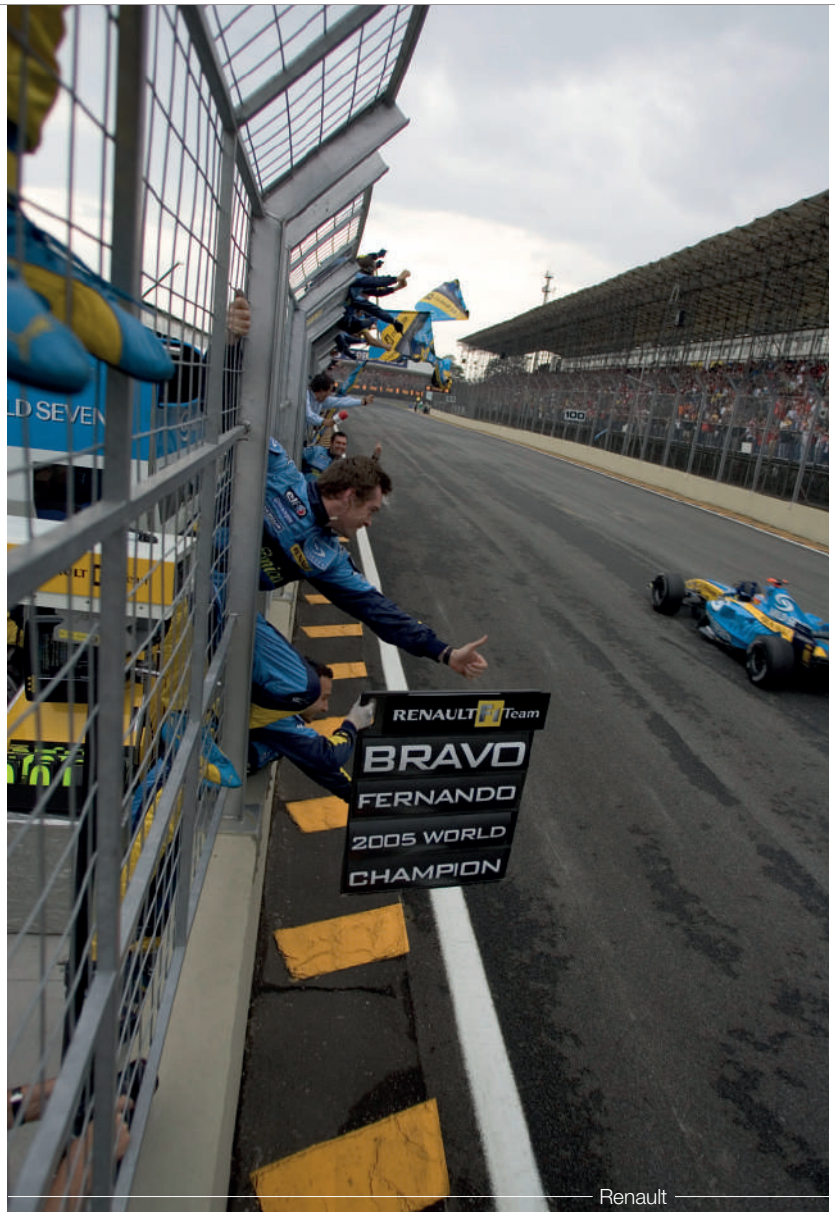


Renault

Could the new engine rules be curtailed before their planned five-year life-cycle is up, though?

Since Ben Sulayem's intervention, the FIA has already sought to calm expectations. Its single-seater director Nikolas Tombazis says: "The progress with sustainable fuels etc has led to views that maybe the engines could be simpler.

Too expensive

"The world economy does lead to views that maybe we should try to cut costs a bit more and the current power units are way too expensive. That is a fact. We would like them to be cheaper.

"And that's why the president made the comments about V10 engines in '28, or '29 or whatever and so on. And that is something we are evaluating with the PU manufacturers.

"We are discussing openly with them the best direction for the sport. If there was ever any such decision, what would happen in the intervening period, we would have to see. But we would never unilaterally change something and impose something without full discussion."

ABOVE Fernando Alonso was the last F1 driver to win a world title with a V10 engine

Teams and engine manufacturers have privately raised a series of questions about the idea of V10s returning to F1.

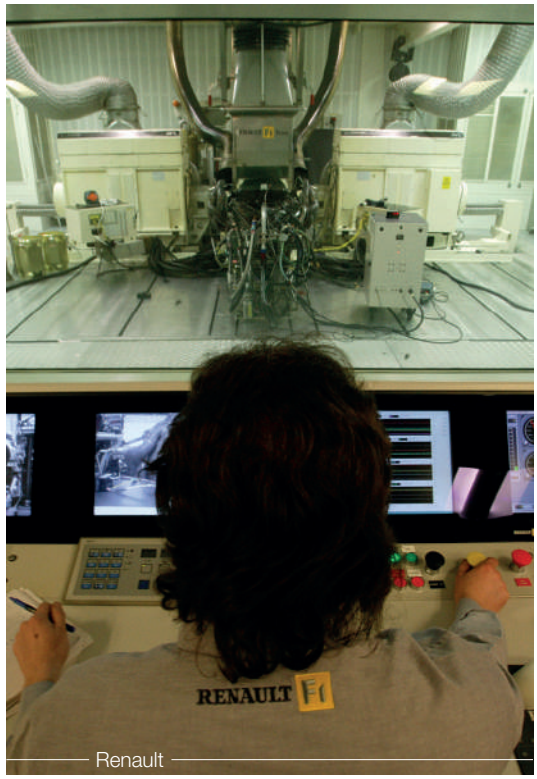
Firstly, why a V10, specifically? If it's about reintroducing a dramatic noise, why not a V12? And on the same topic, Ben Sulayem referred to "future technological motorsport trends". But the V10 is very much not that. No major manufacturer uses one, and there is no investment in them.

A V8 at least would have some road relevance as an engine that manufacturers are still investing in, for cars such as the Ferrari 296, the Audi RS6, Mercedes AMG E63, all McLarens and so on?

> *"Ben Sulayem referred to 'future technological trends'. But the V10 is very much not that. No major manufacturer uses one"*

The idea that this plan would cut costs is also questionable. The manufacturers are said to have invested around $400m in the new engines already. They are hardly about to chuck that all the bin, only to then have to spend millions more developing a new engine that has no significance beyond F1.

The burgeoning weight of F1 cars has been used as an example of why going back to a naturally ▶



Renault

RIGHT V10s haven't occupied the minds of the F1 teams' tech departments for 20 years, since Renault's 3.0-litre RS25 ruled the roost

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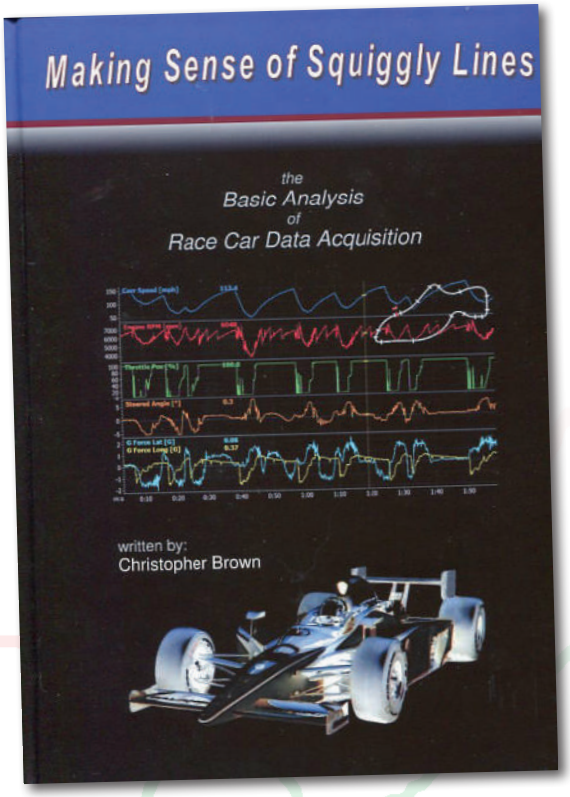

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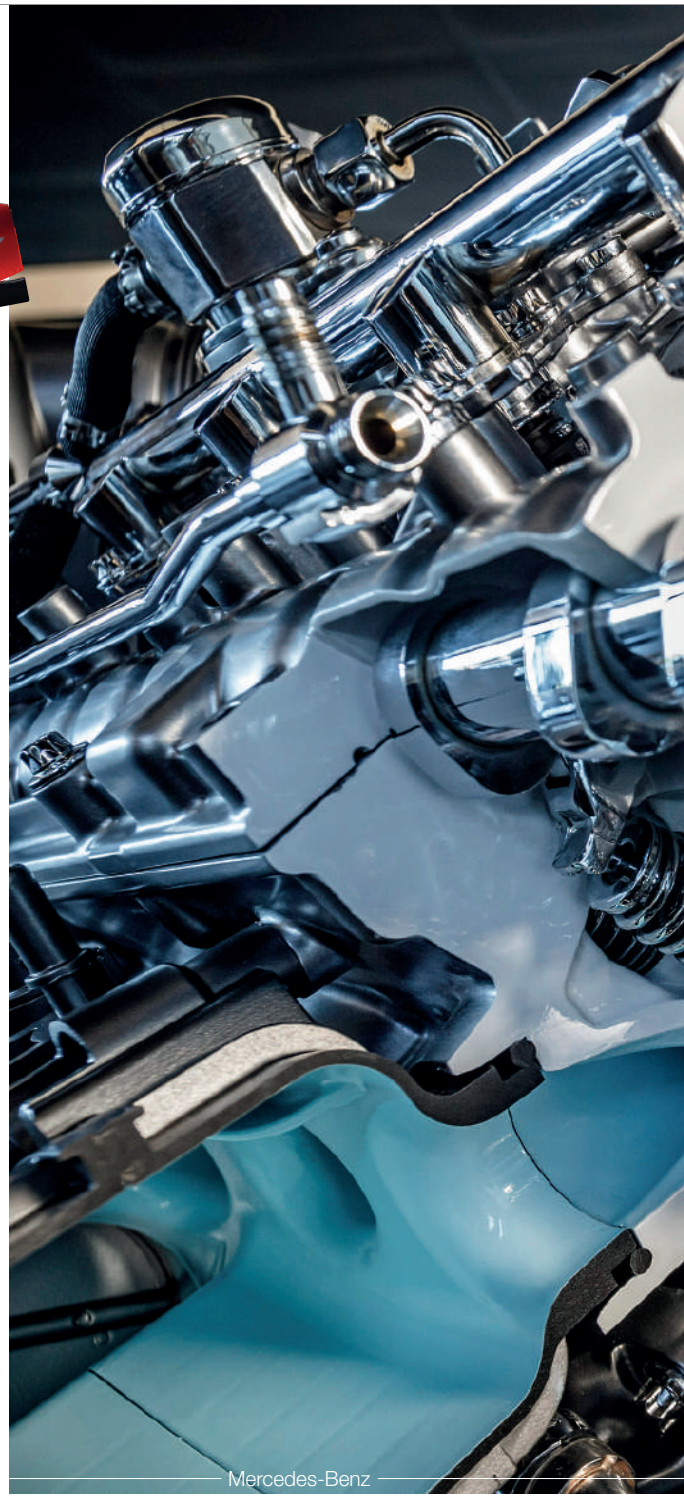

Mercedes-Benz

> *"It's 10 past midnight and Cinderella's left the building"*

aspirated engine would work. It's true that hybrids are heavier, because of their batteries, and that the weight of F1 cars has increased from about 550 kg in 2005, the last time V10s raced, to about 800 kg now.

But the majority of that weight increase is accounted for by improved safety systems, such as the halo head-protection device. None of which is about to be taken away.

On top of that, when F1 last used naturally aspirated engines, the cars started races with about 160 kg of fuel on board. Now, that number is 100 kg, and will be about the same next year. Going back would lead to a significant increase in fuel weight.

And that leads to question marks about sustainability. The new fuels to be introduced next year are not fully carbon neutral. They reduce emissions by a little over 80%. Increasing the amount of fuel used by 60% would increase emissions by the same amount.

ABOVE The uncertainty could spook new manufacturers like Audi, who have already invested heavily in the next generation of sustainably-fuelled hybrid engines

Reach for the earplugs?

As for the idea that the fans would welcome the return of much louder engines, it is more than 10 years since they were used in F1. And in the last eight years or so, F1's fan base has not only significantly increased thanks to social media and the Netflix Drive to Survive series, but its demographics have changed.

More women are now interested in the sport, and the audience is getting younger. Many of them have never heard a V10 engine. Who says they want them? Where's the research? And then there is the noise itself – ear-splitting, deafening, headache inducing. So loud, you can't hope to have a conversation while it's going on. How would that go down with the corporate guests in the paddock club, to name just one group?

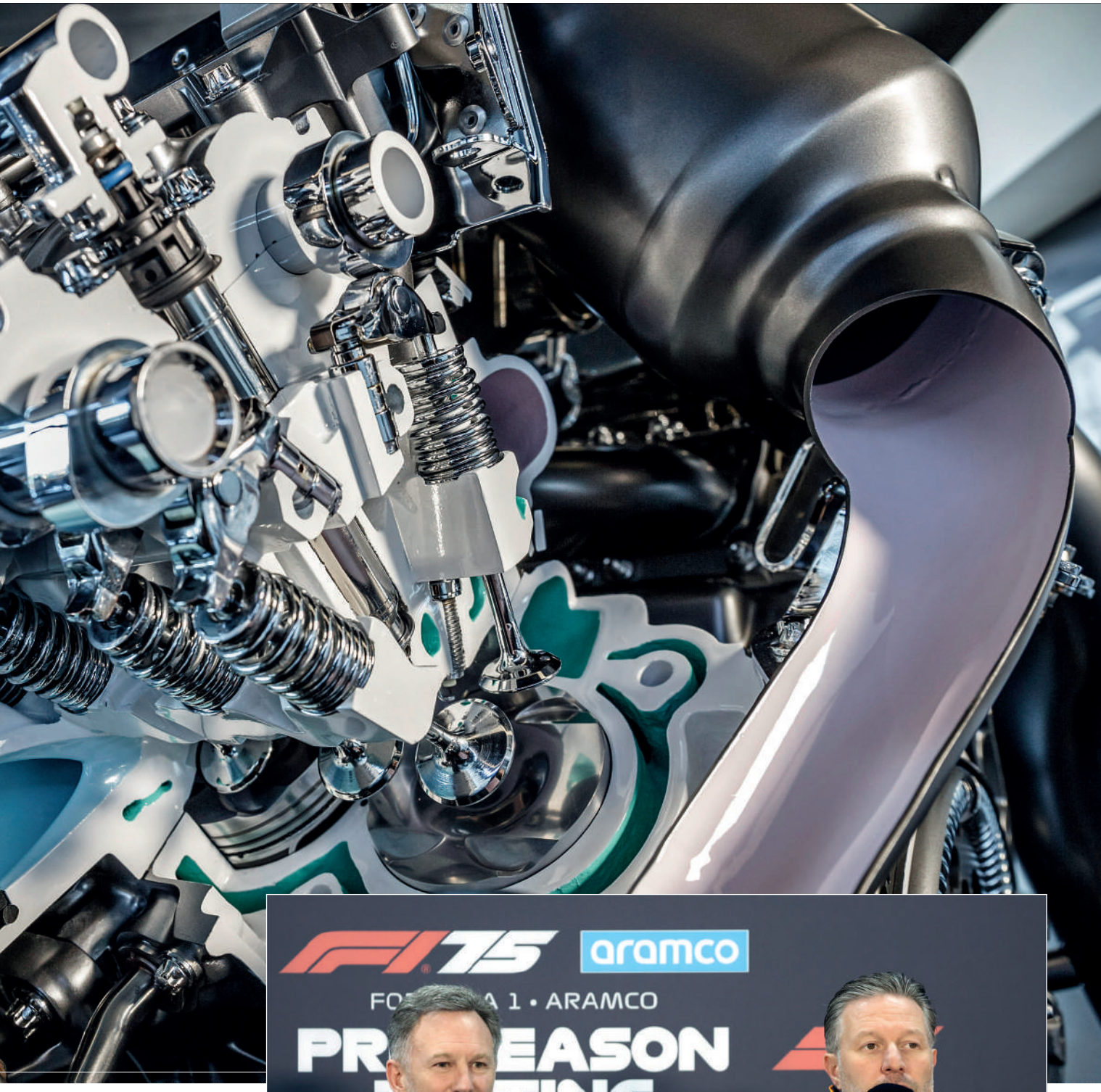
And then there's the time it would take to properly debate a new engine formula – then to build whatever engines are decided upon. At least four years, realistically.

ABOVE RIGHT Even switching to a V8 would have more relevance, given that manufacturers are still investing in them. This is Merc's new AMG 4.0-litre V8 biturbo engine

Insiders say that for all the bluster, not one serious conversation on this topic has taken place among the group that decides where F1 goes.

When it does, and they properly address all these issues, are the chances that the solution they will land on is a naturally aspirated V10 really that high? Pardon the pun, but it doesn't sound like it.

Andrew Benson is BBC Sport's F1 correspondent



Getty Images/Red Bull Content Pool

RIGHT Red Bull Team Principal Christian Horner is open to a change of PU direction; McLaren counterpart Zak Brown believes that ship has sailed

‘HERE BE DRAGONS!’

It’s easy to wander into dangerous territory when navigating the fast-changing automotive landscape. **Chris Pickering** consults Professor Steve Sapsford, a key contributor to motorsport’s technology roadmaps

ABOVE The move towards sustainable fuels, for which Formula 1 becomes a standard-bearer next year, is one of the biggest shifts in the industry

FIA/Formula 1

EVERYTHING starts with good intentions. When it comes to sustainability in the automotive industry, the ultimate goal is clear: we need to be carbon neutral sooner rather than later.

But translating those good intentions into a workable action plan is where it gets difficult. There are numerous different technologies, all with their own challenges to overcome. And yet sometimes the politicians and policymakers don't fully understand the distinctions between these technologies, much less which ones they should pick.

Roadmaps, such as those drawn up by the UK Automotive Council, are designed to establish a potential route to these long-term aims. The Motorsport Industry Association (MIA) has its own version. Steve Sapsford was a key contributor to both. Formerly director of business strategy and global market sector director for high performance vehicles and motorsport at Ricardo, Sapsford is no stranger to navigating the twists and turns of automotive policy.

The roots of the Automotive Council roadmaps go back to 2013. Then as now, there was an awareness that the automotive landscape was changing. The second-generation Toyota Prius had become a must-have accessory in Hollywood and it was popularising the idea of hybridisation among consumers in much the same way that the Tesla Model S was about to do with fully electric vehicles. It was also at the peak of the turbo downsizing era in mainstream combustion engines and other buzzwords like fuel cells, connected and autonomous vehicles, and lightweighting were starting to fill the air.

Quest for clarity

The Automotive Council roadmaps were created in response to these changes, with the aim of bringing some clarity to the frenetic mixture of different ideas. The MIA roadmap followed later that year and aimed to set out much the same agenda for motorsport.

Since then, the situation has continued to evolve. The roadmaps have been periodically updated, with the latest revisions to the MIA's motorsport document released last year.

"We'd done incremental updates previously, where not much has changed, but I was quite surprised when we put together the latest version at just how much things had moved on," recalls Sapsford. "One of the big changes is likely to be the impact of AI. In theory, it can be applied to everything from the design process and manufacturing optimisation through to race strategy and energy management. My comment at the time was that AI in motorsport probably deserves a roadmap of its own."

It's acknowledged that AI in its various forms has the potential to be a hugely effective tool. At the same time, it's not always easy to see how this could be applied to motorsport problems.

"We had a lot of discussion at the World Motorsport Symposium recently about how AI can actually be applied," notes Sapsford. "A lot of the mainstream

applications of AI appear very impressive, but they're mainly large language models that are looking for patterns. In engineering, you need to solve real, physical problems with discontinuities. So, there are patterns in there, but you don't just need to know the answer, you need to know why it's the answer."

The other major trend is that sustainable fuels – once seen as a token effort before electrification would take over – are now very much top of the agenda.

"Four or five years ago, practically nobody in motorsport was using sustainable fuels, but now everybody is clambering to get them. Formula 1 is going 100 per cent sustainable next year, and some series have already done that. These fuels are a very effective way of decarbonising existing forms of motorsport, extending right back down into grassroots," says Sapsford.

"As soon as you reach the level where people are paying several pounds a litre for race fuel, you're into an area where it's possible to give them a sustainable fuel instead. It means that a lot of people can decarbonise much more cost-effectively than having to completely rip out their powertrain and go all electric. I think that's one of the big shifts."

Hydrogen hopes

Alongside the drop-in fuels that can be run in existing engines with little or no modification, Sapsford notes that there's a flurry of interest in hydrogen: "That's something that's really taken off recently. I remember a discussion between manufacturers and regulators where there was this realisation that hydrogen didn't have to be fuel cells. People were just starting to talk about hydrogen combustion and the comment was made that we need to be careful not to rule out hydrogen combustion by mistake. Since then, the interest in hydrogen combustion has spiralled."

The differences in mass, power delivery and packaging requirements mean that bringing fuel cells and hydrogen combustion engines together with some sort of parity on the racetrack would be harder than leaving manufacturers to fight it out in the road car market. As such, writing a set of regulations to cover both technologies is clearly going to be a challenge, but it's important not to inadvertently rule one out.

Terminology can also be very important, as witnessed by the EU's decision to amend the proposed ban on new petrol and diesel cars in 2035. Not long after the ban had initially been proposed, there was a move to include an exception for sustainable fuels, which covers a multitude of different options. Except, when the official communication came out it only referred to "e-fuels". It's not known whether this was a case of mistaken terminology or a deliberate shift towards that one technology, but at a stroke it had ruled out several other options that could help to decarbonise road transport.

"I think there is a realisation that you can't expect electrification to shoulder the ▶

entire burden of decarbonising transport by 2035," comments Sapsford. "We're going to need all the help we can get. It's about which *combination* of these technologies can give us the biggest net carbon reduction in the shortest time and at the lowest cost. The end point might not change, but we could do a lot of good on the way. Without acknowledging that, I think we could run into a case of 'perfect being the enemy of good'."

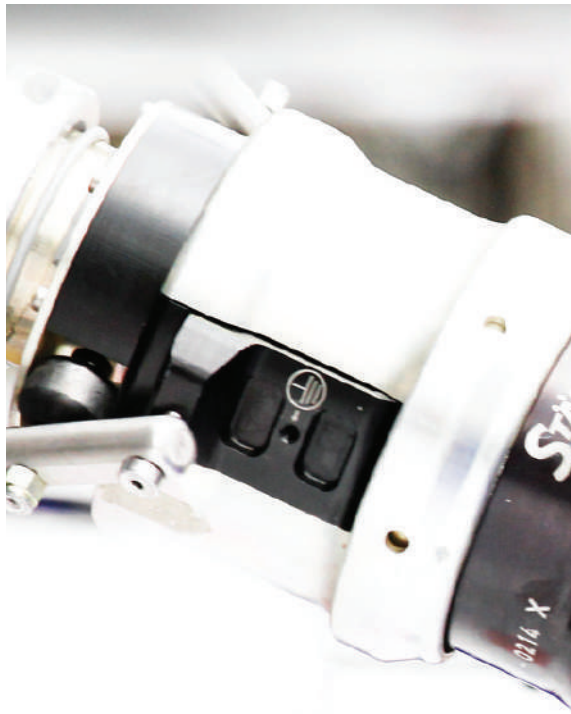
The fundamental principles of hydrogen combustion are not that different to burning a fossil fuel. The key difference is that there is no carbon in the fuel, so it cannot form CO2, methane (another potent greenhouse gas) or particulate matter in any significant quantities. Trace quantities can still be produced indirectly by the combustion of engine oil.

The composition of the air going into the engine, of course, doesn't change. It's still 78 per cent nitrogen, which means that the high temperatures traditionally associated with hydrogen combustion have the potential to result in significant nitrogen oxide emissions. However, lean burn concepts reduce the in-cylinder temperatures and reduce NOx emissions to the point where they are considerably lower than a typical gasoline engine.

"People often say that hydrogen combustion produces a lot of NOx, but that depends on how you run the engine," comments Sapsford. "Hydrogen ignites so easily that you can run very lean. If you do that, the amount of NOx produced by a hydrogen combustion engine is tiny."

The biggest challenge with hydrogen is distributing and storing it – both on and off the car. By mass, hydrogen is around 2.8 times more energy-dense than gasoline, but the tanks required to store the pressurised gas are comparatively large and heavy. As a rule of thumb, hydrogen requires around four times as much storage volume as the equivalent quantity of gasoline. Part of this comes down to the tank construction, which needs to be particularly robust to cope with the pressures inside. Cryogenic storage overcomes this to a certain extent, but storing liquid hydrogen at -253 deg C brings its own challenges.

Once inside the engine, the differences to gasoline combustion aren't huge, but detail changes are likely to be required. Exposure to hydrogen can cause lubrication issues and embrittlement of the components, which along with the high peak temperatures can make material choices critical. Hydrogen also



ABOVE & RIGHT
As the official fuel supplier of the FIA World Endurance Championship (WEC), TotalEnergies provided the first 100% renewable fuel to be used by all competitors in an elite international motorsport series: Excellium Racing 100

> ***"Motorsport cannot afford to be accused of greenwashing. If a series using 'sustainable' fuel was found to be using fossil fuel it would destroy the industry"***

has a tendency to displace oxygen, which means that controlling the gas flow in and out of the cylinder can be tricky. None of these issues are insurmountable, however, and as several manufacturers have recently proved, it is possible to modify an existing race engine to run on hydrogen.

Liquid fuels

A simpler alternative is to stick with liquid fuels, but to move away from fossil feedstocks. In some cases, minor modifications are required to the fuel system to ensure material compatibility, but the aim at least is to provide a true drop-in substitute for conventional gasoline.

However, the term sustainable fuels covers a wide range of different technologies, which are frequently confused or even deliberately abused. Broadly speaking, there are three main categories: Biofuels are made by the fermentation of plant-based material or the hydrotreatment or esterification of plant-based oils (with a further distinction between first generation biofuels that use food crops and second generation fuels that use agricultural waste and other non-food sources); synthetic fuels, which use the Fischer Tropsch Process to convert carbon monoxide and hydrogen into liquid hydrocarbons; and e-fuels, which are a specific subset of synthetic fuels, where renewable electricity is used to create the hydrogen through processes such as electrolysis.

DPPI/FIA/WEC

These all have different pros and cons, different price points and different levels of technological readiness. In many cases, a small amount of non-sustainable content is currently used to provide additive packages; in theory, these semi-sustainable fuels can still be certified as 100 per cent sustainable using a system known as mass balancing (more on that in a minute) but there are fully sustainable alternatives in development.

"The term low-carbon fuel is something of a misnomer for the sustainable gasoline-type fuels," notes Sapsford. "They've got as much carbon as a traditional fuel and they release as much carbon when they're burnt. The key difference is where the carbon comes from: is it 'old' carbon that was safely sequestered in fossil fuel reserves until someone dug it up or is it 'new' carbon that was already in the atmosphere that you've recycled through carbon capture or by growing plants. What ultimately matters is the net change in carbon in the atmosphere as a result of producing and burning the fuel."

Auditing fuels

One of the challenges with these fuels is that they can be chemically identical to their fossil-based equivalents, with the same physical properties. So how do you verify a fuel supplier's claim that they're using sustainable hydrocarbons?

There is one way to tell. The radioactive isotope carbon-14 is constantly being created in the Earth's atmosphere by the interaction of cosmic rays with atmospheric nitrogen. This combines with oxygen to produce a radioactive form of carbon dioxide, which can then be dated by measuring the extent to which the isotope has decayed since its creation. Beyond about 50,000 years, the amount of carbon-14 becomes too small to accurately measure, which means that it can't be used to date fossil fuels. However, 'new' carbon that has been freshly recycled ▶

Alpine

from the atmosphere will still contain measurable quantities of carbon-14, making it possible to distinguish between the two.

Radiocarbon dating is an expensive process, but it could allow governing bodies to carry out occasional spot checks to verify that the hydrocarbons in their fuels do indeed come from sustainable sources. A more practical approach is to establish an audit trail, all the way from the original feedstock through to the finished fuel,

> ***"Sustainable fuels – once seen as a token effort before electrification would take over – are now very much top of the agenda"***

which is precisely what the FIA and the Zemo Partnership plan to do with the new Sustainable Racing Fuel Assurance Scheme (SRFAS).

"Motorsport simply cannot afford to be accused of greenwashing. If a series using 'sustainable' fuel was found to be fossil fuel it would destroy the industry," comments Sapsford. "The SRFAS scheme tracks the feedstocks, the energy input to the production process, the transport emissions and a whole load of other factors all the way to the finished fuel. It has its origins in a scheme that Zemo put together for fleet haulage operators to ensure that fuels such as HVO and FAME biodiesel delivered the net carbon savings that they claimed. The new scheme is currently focused on Formula 1, but is likely to be rolled out to FIA Appendix J formulas soon."

ABOVE Interest in hydrogen has spiralled. Alpine's Alpenglow is one of the hydrogen combustion pioneers

BELOW Hydrogen on the road? The MissionH24 project hopes to influence public perception of the technology

The current Formula 1 scheme requires the sustainable fuel to go down a completely separate manufacturing process to conventional fossil fuels to prevent contamination at any point. This provides an extra level of assurance for small batches of fuel, but it may not be practical once sustainable fuels are employed in greater quantities. ▶

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Mixed streams

"My speculation is that once the SRFAS is extended to Appendix J it's likely to allow mass balancing, simply from a cost perspective. It's far more cost effective to process stuff in mixed streams and do the mass balancing than it is to keep it all separate," comments Sapsford.

Mass balancing is a carbon credit system. Essentially, what it says is that providing that a certain amount of sustainable content is placed into a mixture, the same amount can be withdrawn from that mixture later on and deemed to be sustainable. For instance, if you had a mixture comprised of 25 per cent sustainable fuel and 75 per cent fossil fuel, you could certify a quarter of it as fully sustainable or half of it as 50 per cent sustainable and so on. It's the same logic that states that adding 10 per cent sustainable content to the tank of every car on the roads will achieve the same net benefit as running one in 10 cars on fully sustainable fuel.

Mass balancing often comes in for criticism as it's potentially open to abuse and you can't guarantee that any given sample of the mixture was derived wholly from sustainable sources. It also covers up the inconvenient truth that some fuel additives are currently very difficult to produce through sustainable means. But – done properly – the logic is sound, and it allows sustainable fuels to be processed in existing large-scale facilities that also handle fossil fuels.

Mass balancing

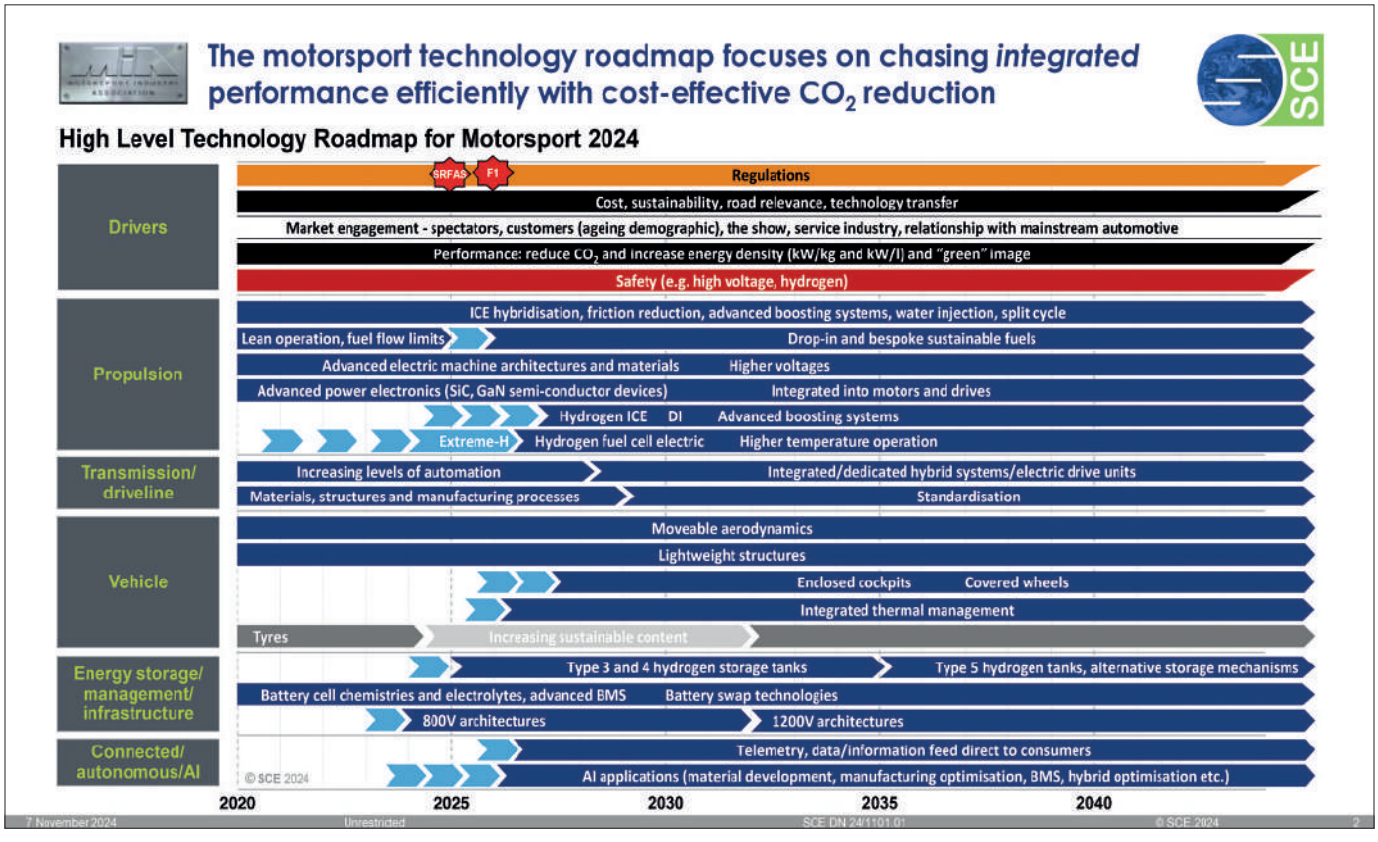
"People often complain about mass balancing," explains Sapsford, "but it's very similar to electricity. When you sign up to a renewable energy tariff you're still connected to a mixed grid with power from lots of different sources; it's not as if they direct the green electrons from the wind turbines and the solar farms exclusively to your house. But they can ensure that the amount of electricity that they sell as renewable matches the amount that comes in from renewable sources. Ultimately, it achieves the same thing."

The comparison to renewable electricity is apt. Providing it offers the same physical and chemical properties, sustainable gasoline can be mixed into the pumps in any percentage – it doesn't have to ▶

FIA/Formula E

BELOW The latest developments like fast charging, introduced this season in Formula E, play to motorsport's strengths

BOTTOM The impact of AI could lead to significant revisions of the technology roadmap



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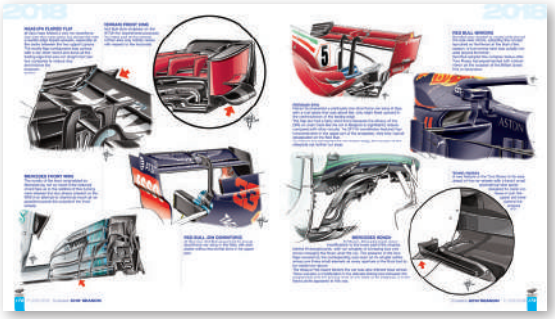

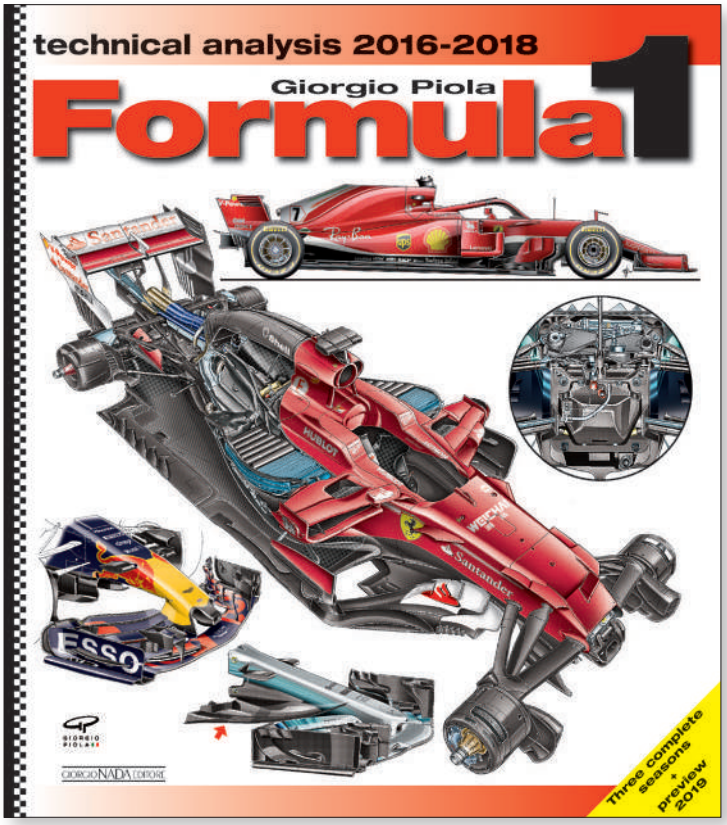

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LEFT Sustainable fuels are proving an effective way of decarbonising existing forms of motorsport

RIGHT The task of storing hydrogen in liquid form at -253 degrees C is another unexpected change of direction. Toyota is one of the manufacturers rising to the challenge. Its switch to an elliptical tank in its experimental Corolla H2 has increased the payload of hydrogen by a third

be an 'all or nothing' approach. That raises the question of how much benefit you could achieve by mixing, say, 10 per cent sustainable gasoline into the current E10 pump fuel – and how many EVs you'd need to sell to achieve the same results.

No backtrack

There has been an increasing amount of dialogue around sustainable gasoline and other fossil-free combustion fuels in the past year or so. This has perhaps contributed to rumours that the industry is backtracking from electrification, but Sapsford isn't convinced.

"I think the trajectory for light duty vehicles will remain all-electric, but there's perhaps a growing awareness that it will take a long time to achieve that," he notes. "There are around 30 million cars on the road in the UK, and just under 2 million new cars sold each year. So, even if the new car market went fully EV right now, it'd take 15 years to replace all of those, and that could be too late. Actually, if you add

Porsche AG

LEFT Porsche has invested in the Haru Oni pilot plant in southern Chile as it pursues the viability of e-fuels

Photos: Toyota

> *"The term sustainable fuels covers a wide range of different technologies, which are frequently confused or even deliberately abused"*

a little more sustainable content to the fuel used by each of those remaining ICE cars during that transition, the net effect over 15 years could be massive."

There's likely to be another turbulent year ahead, but right now the UK motor industry is on track to meet its annual electric vehicle targets for the government's ZEV Mandate (which allows credits for low-emissions combustion vehicles as well as pure EVs). So, it appears that rumours of the EV's demise have been greatly exaggerated, although a holistic approach that takes into account different energy sources for niche applications and existing vehicles on the roads seems to make sense.

But how does this link back to motorsport? That's a question that the motorsport industry itself must grapple with. If, for instance, the passenger car market was to end up dominated by EVs and hydrogen became the preferred choice for heavy duty trucks, would it still make sense for a carmaker to invest sponsorship money in a combustion-engined series?

"People know what they like. There are already people out there who are drawn to things like Formula E and others who want the noise and smell of traditional racing. I think [that mixture] will continue, with electric racing, fuel cell racing, hydrogen combustion and sustainable gasoline all operating in parallel," comments Sapsford.

"As to whether the brands will change if the technology diverges from road cars, I don't know, but we have seen fluctuations before. Back in the early 2000s, we had Formula 1 producing 20,000 rpm engines that had no road relevance whatsoever. And then with turbocharging and hybridisation, we saw the technology come much closer. It was something that we were very much aware of when we put together the first MIA Motorsport Technology Roadmap. The industry has done very well to align those technologies, but I feel that now we might start to see them diverge again somewhat."

ICE reprieve?

Far from stagnating technologically, he believes that the motorsport industry could benefit from retaining the internal combustion engine: "Businesses that might have been staring down the barrel of a gun two or three years ago [when the focus was largely on electrification] might find that they have a brighter future now – especially with the advent of hydrogen combustion.

"Hydrogen engines need a lot of air, so there's a whole new scope to develop more advanced boosting systems, and there's all the lean burn direct injection technology. That's the sort of thing that we're very good at tackling in motorsport. And in parallel to that, we've got topics like high-voltage rapid charging and new battery chemistries to look at on the electrification side. There's going to be loads of opportunities out there."

It's a brighter assessment of the situation than you might get from some. But there again, that's what motorsport teaches engineering businesses to do – improvise, adapt and overcome. Whatever the future holds, it seems likely that small, agile businesses in motorsport will be better placed to react to it than the corporate giants staring into their crystal balls.

THREE WEEKS TO SAVE THE WORLD CHAMPIONSHIP

TotalEnergies answered the FIA's 'SOS' signal when the World Rally Championship's supply of sustainable fuel was suddenly jeopardised. **Chris Pickering** gets the inside story

THE news that the World Rally Championship (WRC) needed a new fuel supplier came as a shock to all concerned. At the port of Mombasa, a shipment of fuel for the Safari Rally Kenya was stranded at the docks after it emerged that the previous supplier, P1 Fuels, had gone into administration, leaving the customs fees unpaid. At that moment, it wasn't clear whether there would even be any fuel for the classic East African event to take place.

Fortunately, the FIA stepped in and paid the fees to have the fuel released and shipped out to the teams by the time they reached the rally HQ at Naivasha in the Great Rift Valley. The show *did* go on. But behind the scenes, the race to find a new supplier had already begun.

A phone call came through to TotalEnergies on the outskirts of Paris. In many respects, the French energy giant was the obvious candidate to take over the role, with a proven track record of delivering sustainable fuels for the World Endurance Championship (WEC) and the European Truck Racing Championship (ETRC). With P1's contract to supply fuel to the WRC due to conclude at the end of this season, TotalEnergies had already entered the tender process for the 2026 to 2028 agreement (which remains active).

But now, suddenly, the FIA's plans for 2026 were set aside for more pressing matters: could TotalEnergies deliver a suitable fuel in time for the remainder of this year?

"We knew it wouldn't be easy," explains TotalEnergies' motorsport technical manager, Thomas Fritsch. "Developing a new competition fuel takes one and a half to two years, so there was no question of developing a new blend in that time. At such short notice, you need to have an existing product already sitting in the warehouse."

By fortunate coincidence, TotalEnergies had just the thing. A sustainable blend developed for domestic rally championships that had been tested and approved for use, but which had yet to be launched commercially. Just as quickly as the old supplier had been lost, a new one had been found.

"Everything was done in three weeks from the first discussion," comments Fritsch. "So, it was really a huge effort from our teams – not just from our fuel development team, but also the people dealing with business, logistics and fuel distribution. Fortunately, we had some flexibility in the other projects we were working on to focus on this side for a few weeks."

> *"A sustainable blend developed for domestic rallying that had been tested and approved, but yet to be launched commercially"*

The TotalEnergies fuel will make its debut at the next round, Rally Islas Canarias, from which point the WRC circus will remain in Europe until the end of August.

"We are lucky, because the next few events are closer to Europe, which

ABOVE RIGHT The new rally fuel is based on advanced sustainable molecules, like the Excellium Racing 100 blend the company supplies to the WEC

RIGHT TotalEnergies has also thrown its hat into the ring to supply sustainable fuel for the World Rally Championship through its next contractual cycle, from 2026-2028

simplifies the logistics a little, but it's still a big challenge. We don't just have the Rally1 category, but also Rally2 and Rally3 to supply. On top of the rallies, there are also test events and the teams' own dyno testing to support."

New formulation

Like the Excellium Racing 100 blend that TotalEnergies supplies to the WEC, the new rally fuel is based on advanced sustainable molecules that are well defined by FIA regulation. However, it is an all-new formulation, using different processes and feedstocks. The fundamental requirements, too, are somewhat different in the two categories.

"Ultimately, you always want to provide the best performance and the best fuel economy for any fuel," ▶

Getty Images/Red Bull Content Pool

Delfosse/DPPI/WEC

says Fritsch. "Of course, the priorities change slightly. In endurance racing, fuel consumption is extremely important, because the stint lengths and the pit stops are part of the race. That depends to a certain extent on the fuel. As an example, if you look at cars that run on E85 (85 per cent ethanol blends), their consumption is a lot higher. Ethanol content is just one area – there are lots of other components that can impact things like fuel consumption."

The in-cylinder conditions are quite different too. Even without the recently abandoned hybrid systems, modern WRC cars squeeze around 380 hp from their 1.6-litre turbocharged four-cylinder engines, which equates to just under 240 hp/litre. In theory, the 2.6-litre V6 in the Peugeot 9X8 – the smallest engine on the LMH grid – eclipses this at 295 hp/litre, but much of the time it is drawing significant assistance from its 200 kW (270 hp) hybrid system. At the other end of the Hypercar scale, the non-hybrid Aston Martin Valkyrie AMR-LMH delivers a quoted 680 hp (500 kW) from its 6.5-litre naturally aspirated V12, which equates to just 105 hp/litre – well under half the specific output of the rally engine.

Knock resistance is particularly critical on these highly turbocharged engines. Rally cars also tend to spend more time at part-throttle in low grip situations and on the road sections between special stages, so the pedal mapping is quite different.

The sheer breadth of machinery from small capacity turbos to big naturally aspirated V8s and V12s in the types of engines. In rallying, you already have commonality across the engines, so you can go directly to maximising performance, reliability and consumption. I wouldn't say it's any easier overall, though, because that just means you can go deeper in optimising the fuel for that particular engine configuration."

ABOVE The engines in the World Endurance Championship have different demands, meaning it wasn't as simple as simply producing more of the same fuel

the WEC poses its own challenges, however. The advantage you get with WRC engines is that there are only three manufacturers, all of whom are constrained to using very similar engine configurations.

"Having the same engine layout definitely helps," comments Fritsch. "When you are looking for performance in a rally fuel, you know that you have to optimise the formulation to suit turbo engines. The big challenge of endurance racing is that you need to engineer a fuel that will provide comparable performance, reliability and consumption on all

> *"We tried to be more industry relevant, applying the same processes we use in our refineries for our road products"*

Promising tests

In theory, the old P1 fuel was a drop-in replacement for the WRC's previous fossil-derived fuel, with the same chemical specifications. Reports at the time, ▶

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however, suggested that a number of teams ran into compatibility issues when it was first introduced in 2022. This raises the question of how the new fuel will compare. TotalEnergies hasn't had a chance to sample the previous blend, but Fritsch says that the initial feedback seems promising.

"We're turning a new page with this fuel. In three weeks, you simply don't have time to do a proper back-to-back analysis. We trusted this technology, so we were quite confident to show it and to supply it to the first manufacturers to test it. And so far, things are looking good."

As we speak, it's less than a fortnight since the first samples were shipped out. Unsurprisingly, the teams were in a hurry to commence calibration work, but Fritsch says that the amount of in-house testing carried out both at TotalEnergies and its technical partners gives him plenty of confidence.

"At the end of the day, it's not that different to producing any other control fuel for a motorsport championship. If you're a single supplier you need to ensure equity, so you can't involve any one of the manufacturers in the testing. You have to carry out your own testing and then release the fuel to all of the manufacturers at the same time," comments Fritsch.

The exact details around how the new fuel is processed remain confidential for the time being, but Fritsch says that close attention has been paid to road relevance: "We tried to be more industry relevant [with this latest fuel] and to apply the same processes that we use widely in our refineries for our road products to be more energy efficient. Ultimately, that means more CO2 saved across the lifecycle of the fuel."

Elsewhere in the industry, there has been a lot of discussion around the development of e-fuels – where renewable energy is used to create hydrogen through processes such as electrolysis, which is

RIGHT The energy giant has a proven track record, having supplied sustainable fuel both to the WEC and European Truck Racing Championship (ETRC)

BELOW & LEFT The energy sector is changing, so is TotalEnergies. Motorsport is proving an extremely useful laboratory

then processed into hydrocarbons. TotalEnergies has been keeping a watchful eye on this technology – it's part of a coalition of seven international companies set up to explore the potential of e-natural gas, which uses similar methods to create a low-net-carbon fuel for shipping and heavy industry. On the automotive side, however, TotalEnergies is focusing its sustainable fuel efforts on biofuels.

"For now, biomass-derived fuels are leading the game because they are more cost-effective and available in far larger volumes. How this looks in the future will depend on the progress made in e-fuels. It's part of our job to look at all these possibilities and deliver the most cost-effective, sustainable and technologically appropriate fuels to our customers," says Fritsch.

Between the WRC, the WEC and IndyCar, sustainable fuels have already spread across many of the top-tier international championships, with Formula 1 and IMSA due to follow next year. As such, it could be argued that sustainable fuels – in its various forms – already constitutes a pretty mature technology in motorsport. However, the big challenge remains mainstream adoption for road vehicles and other industries.

"If you imagine just one fuel station on the main highway going down to the South of France in July or August, they probably sell the same amount of fuel in one month than we sell to motorsport all season. The volumes are just not comparable," admits Fritsch.

Nonetheless, there are areas where motorsport and road fuels can benefit each other, he says: "Motorsport has a lot to bring to road applications, like testing new fuel components in small batches on very specific types of engines. It's a fantastic laboratory for new ideas. On the other hand, road fuels are very heavily optimised for things like lifecycle CO2 reduction and cost control, so there are concepts we can bring from that side that benefit motorsport. A strong belief at TotalEnergies is that we should have the same experts working on road and competition products, whether that's conventional fuels, lubricants or hydrogen."

At motorsport volumes, the current supply of biomass feedstocks appears to be adequate – at least for now – but the market for sustainable components is growing rapidly and there is only a finite amount of material that can be extracted from sources such as agricultural waste. Finding alternative ways to upscale remains one of the biggest challenges attached to bringing this technology to the mainstream.

> *"I can imagine a gradual integration, perhaps adding two per cent at a time to existing blends, to drive a clear road map towards sustainable fuel on the road"*

Mainstream transition

Another challenge that comes with the road market is the sheer variety of engines and fuel systems. While series like the WEC may hint at this issue, the situation on the road is far more diverse, with everything from two-stroke scooters to vintage cars potentially filling up at the same pump.

In the end, of course, the biggest limiting factor is cost, which is much harder to satisfy in the road car market than it is in motorsport.

"I don't think we're going to see people running fully sustainable fuels on the road tomorrow. What I can imagine is a gradual integration – perhaps adding two per cent at a time to the existing fuel blends – to drive a clear road map towards sustainable fuel on the road. But, of course, it's not just down to the fuel suppliers. It needs to be a global effort from the consumers, the suppliers, the regulators and the politicians. I would say year upon year, we are unlocking gates and hopefully in a few years, we will have a clear route to achieving this," says Fritsch.

While the timeline for the mainstream energy transition might be counted in years or even decades, things happen far faster in motorsport. Nonetheless, we suspect a three-week turnaround to supply an entire championship represents something of a record. It's certainly one of which Fritsch and his colleagues can be justifiably proud. RT

PUZZLING OUT THE PELOTON

Could DS Penske's adoption of a multi-sim setup change the way teams prepare for races in Formula E's 'Peloton'-style era? **Chris Pickering** investigates

WHEN the chequered flag falls, motor racing all comes down to one thing. Track position. While posting the fastest lap might save some dignity for the driver who comes in last, the reality is that speed alone counts for little. The driver who wins is the one who can use that speed to keep their rivals

> *"Putting additional human drivers into the loop gives a much more realistic representation of how scenarios might play out"*

at bay and ensure that they cross the line ahead of everyone else.

This is true in all forms of racing, but it's particularly relevant in Formula E, where energy management plays a huge role and widespread use of spec components limits the scope for one team to engineer a competitive advantage in terms of outright speed.

Often, in Formula E's 'peloton' races, the winner is not the driver who has set the fastest average pace, but the one who best times their charge to the front when the gloves come off for the final lap. Clearly, developing a fast car gives the driver a key tool to assert this advantage, but it's by no means the only factor.

Simulation software has long been used to explore race strategy and energy management, but there's only so far that you can go with a virtual representation of the opposing drivers. Whether one driver can get past another – and how much valuable energy they might consume in the process – depends on a huge variety of factors. Including, perhaps, a little luck.

Having already installed a full-motion driver-in-the-loop simulator last year, the DS Penske Formula E team has recently acquired an additional suite of four compact simulators that it can network together in the same simulation ▶

ABOVE Ansible Motion's compact Theta Seat Sport simulators offer a cost-effective way to bring additional drivers into the simulation environment

LAT Images/Formula E

environment to investigate what it describes as "inter-vehicle and inter-driver scenarios".

The simulators come from Norfolk-based Ansible Motion, which has also supplied a multi-sim setup to a manufacturer involved in US oval racing, where car-to-car interaction plays a similarly significant role.

"The benefit of using multiple simulators is that you can understand how multiple drivers impact a scenario," comments Mark Thommyppillai, simulator group manager at Ansible Motion. "That's particularly relevant in Formula E, where you don't tend to have the run-off area and the space between the cars that you have in, say, Formula 1. The drivers are much more influenced by what's around them – including the other cars."

As anyone who's played *Gran Turismo* can tell you, AI driver models have improved a lot over the years, but they're still not at the point where they can be used to investigate strategy calls that could decide the outcome of a world championship. Putting additional human drivers into the loop with high quality vehicle models gives a much more realistic representation of how the scenarios might actually play out.

"If you try to simulate driver behaviour artificially it becomes very difficult to capture the randomness of human beings," comments Salman Safdar, director of business development at Ansible Motion. "A real driver may attempt to block a pass where an AI driver might concede, or they might decide to save the energy on this lap and fight back later on. You also find that a real driver might use different parts of the track to find grip off-line and things like that. That's why it's important to bring humans into the experiment."

Safdar believes the importance of strategy is only going to grow in Formula E this year, following the introduction of the compulsory Pit Boost charging stops, which add a 10 per cent energy increase.

"If you look back on previous seasons of Formula E,

ABOVE Maximilian Guenther ended the team's two-year wait for a win when he swept to victory at the Jeddah E-Prix

RIGHT The compact simulators use the same distributed data bus (DDB) architecture as the full-fat Delta S3 that DS Penske invested in last year

> *"We could potentially pack the whole grid into one room"*

level of feedback for vehicle dynamics applications, but they represent a far more cost-effective way to bring additional drivers into the simulation environment.

Crucially, the Theta Seat Sport simulators use the same distributed data bus (DDB) architecture as the full-fat Delta S3. This is a synchronous real-time computing environment with open and modular software architecture that enables an almost limitless range of different modules to be added into the virtual world, from hardware-in-the-loop test benches to additional simulators.

By using the same core architecture, the compact simulators can run exactly the same vehicle model as the Delta S3. Aside from multi-sim scenarios, they can also be used individually for other tasks that don't require a full motion capability, such as validating models and providing circuit familiarisation.

Ansible Motion provides the simulator hardware, which effectively acts as each driver's interface to the virtual world. Long-term partner AVL RACETECH supplies the vehicle modelling software, which includes the physical effects of running in close proximity to other cars. Meanwhile, rFpro provides high-fidelity models of the Formula E circuits.

Thommyppillai likens the DDB architecture to the conductor of an orchestra, ensuring that these separate elements all come together cohesively.

"The integration aspect is actually easier than you might think, providing you've designed your architecture from the ground up to be scalable. The challenge is more thinking about the use cases and what additional feedback you give to the driver, compared to simulating one vehicle on its own."

One of the biggest differences is the audio. Even with the comparatively quiet cars used in Formula E, the feedback from the drivers is that they actively listen out to gauge how close they are to the rest of the pack.

"When it's just the 'ego' vehicle on track you can use a relatively basic map that takes things like vehicle speed and rpm from the simulation and uses that to create the sound," explains Thommyppillai. "But once you have multiple vehicles on track you not only have to add those other vehicles, but you need to give some sense of spatial awareness. Part of our job is understanding how best to relay that to the driver through the hardware that we've got. Similarly, we take the forces from the vehicle physics model and look at the best way to provide those cues to the driver through things like the steering feedback – and the motion platform where that's applicable." ▶

some drivers were failing to finish because the situation had changed and they'd drained their battery quicker than expected," he comments. "Bringing in the extra energy from Pit Boost will allow them to race more aggressive, I think, but there will still be a strong strategic element. With multi-sim, a team can put the actual driver in a lot of different scenarios."

Distributed data

Large full-motion simulators, like Ansible Motion's Delta S3 that DS Penske uses, provide the ultimate immersion, but they can cost millions to buy and each unit requires a substantial amount of space to install. The compact Theta Seat Sport simulators that make up the rest of the suite don't provide the same

Total immersion

Most simulator manufacturers agree that the golden rule is only to add something to the simulation if you can simulate it well. With lots of cars in a tight space there is inevitably a degree of contact in a Formula E race. In terms of accurately representing driver behaviour and energy usage, it's vital that a faster car can't simply drive through a slower opponent. But enforcing these basic rules is also an important part of creating an immersive virtual environment. As such, the multi-sim setup has been developed to give drivers feedback when they come into contact with another car.

"The worst thing to do is to train a driver on something quite artificial, because it becomes an artefact that they then don't recognise on the [real] track. And if something is not quite right then you fall into this uncanny valley where it's almost realistic... but not quite," says Safdar. "So you need to be able to provide appropriate and realistic feedback if you're going to add extra vehicles into the simulation."

Damage models are an ongoing area of research for professional motorsport simulation, but it's something that the simulation providers are understood to be actively looking into. "The damage caused by these bumps against the barriers and against the other cars is something that I think we will have a solution for in the near future," notes Safdar.

> *"A real driver may attempt to block a pass where an AI driver might concede or decide to save the energy and fight back later"*

Simplified models can be used to include the aerodynamic effects of travelling in close proximity to other cars. These can alter the drag and the downforce on the vehicle in real-time using a basic set of parameters such as speed and distance from the other vehicle. This, again, is a relatively new field, but it's by no means the first time that it has been used. The FIA is understood to have carried out studies ahead of the 2022 Formula 1 rules shake-up using wind tunnel data and driver-in-the-loop simulators to investigate whether a greater reliance on ground effect would enable closer racing. It seems highly likely that teams using multi-sim setups to look at oval racing would also need to simulate the effects of drafting in some way.

BELOW The additional suite of four simulators are networked together to investigate inter-vehicle and inter-driver scenarios

LAT Images/Formula E

Future plans

With energy efficiency becoming a key factor in everything from GT3 to Formula 1, Safdar says he can foresee a continuing demand for multi-sim setups in motorsport. However, this technology also has the potential to transfer to other markets, he believes: "We see a lot of value in applying the same concept to road car development, especially when you're doing city drives and ADAS development. Again, it's the randomness of city driving, where you have lots of different driving styles and lots of different hazards, so I think it could be very interesting there."

In the longer term, it's also possible that new simulator technologies, such as virtual reality (VR) and extended reality (XR) headsets could strengthen the case for using multiple simulators.

ABOVE Peloton-style races have become a feature at some circuits, with drivers jockeying for position while conserving energy

BELOW Vehicle modelling software can include the physical effects of running in close proximity to other cars

LAT Images/Formula E

"VR or XR could extend the field of view, which is a significant benefit when you've got drivers looking around to check on other cars, but there's also the packaging aspect," explains Thommyppillai. "Other than the motion system, the vision system is the main thing which determines how compact you can make a simulator and how tightly you can pack them. Without the need for fixed display screens we could potentially pack the whole grid into one room rather than just three or four."

A smaller footprint also raises the prospect of the simulators becoming more portable, he points out: "Could we reach a stage where the simulator can be shipped to the track? That way, when the driver comes out of a free practice session, for instance, they could replay the scenario if they identified something that they could do better. Speed of communications could be a factor here too. If the latency of the connection was low enough, you could have the race driver at the circuit working with two or three test drivers back at the factory."

Of course, none of this diminishes the huge range of different tasks that can be accomplished by modelling a single vehicle to a very high degree of accuracy. That will surely remain the focus of most driver-in-the-loop testing. But, once a team has access to multiple simulators, combining them into one environment seems like the next logical step. After all, it's not the track that each driver is out there to beat. It's the other drivers. RT

‘PACKET’ ROCKET!

The suspense is over for those wondering how Škoda would react to being toppled from its WRC2 throne by Toyota. **Hal Ridge** unwraps the ‘Packet 25’ upgrade package

CZECH Republic brand Škoda has been a contender at the front of rallying’s second tier for over a decade and a half with its Fabia hatchback. But its position is under threat.

The writing has been on the wall ever since automotive juggernaut Toyota launched its Yaris Rally2 last year, based on what is fundamentally a homologation special road car. Škoda’s Fabia RS Rally2 was suddenly in danger of losing its status as the go-to machine in such a highly-competitive market.

Come the end of the 2024 WRC2 campaign, it was indeed the Yaris that topped the standings with rising star and works WRC Toyota understudy Sami Pajari at the helm.

Having also lost the ERC title to Hyundai’s Hayden Paddon, what Škoda needed was a response. In late March, the Czech marque revealed just that.

Inevitably, Škoda is batting away suggestions that its ‘Packet 25’ evolution of its hugely successful Fabia RS Rally2 is a direct response to the competitiveness of the opposition. Either way, the timing couldn’t have been better: the news broke as Škoda-backed Toksport-run

Upgraded engine management software
Optimised exhaust manifold for better thermodynamics and increased power output

Škoda Auto

driver Gus Greensmith claimed WRC2 victory on the recent Safari Rally Kenya.

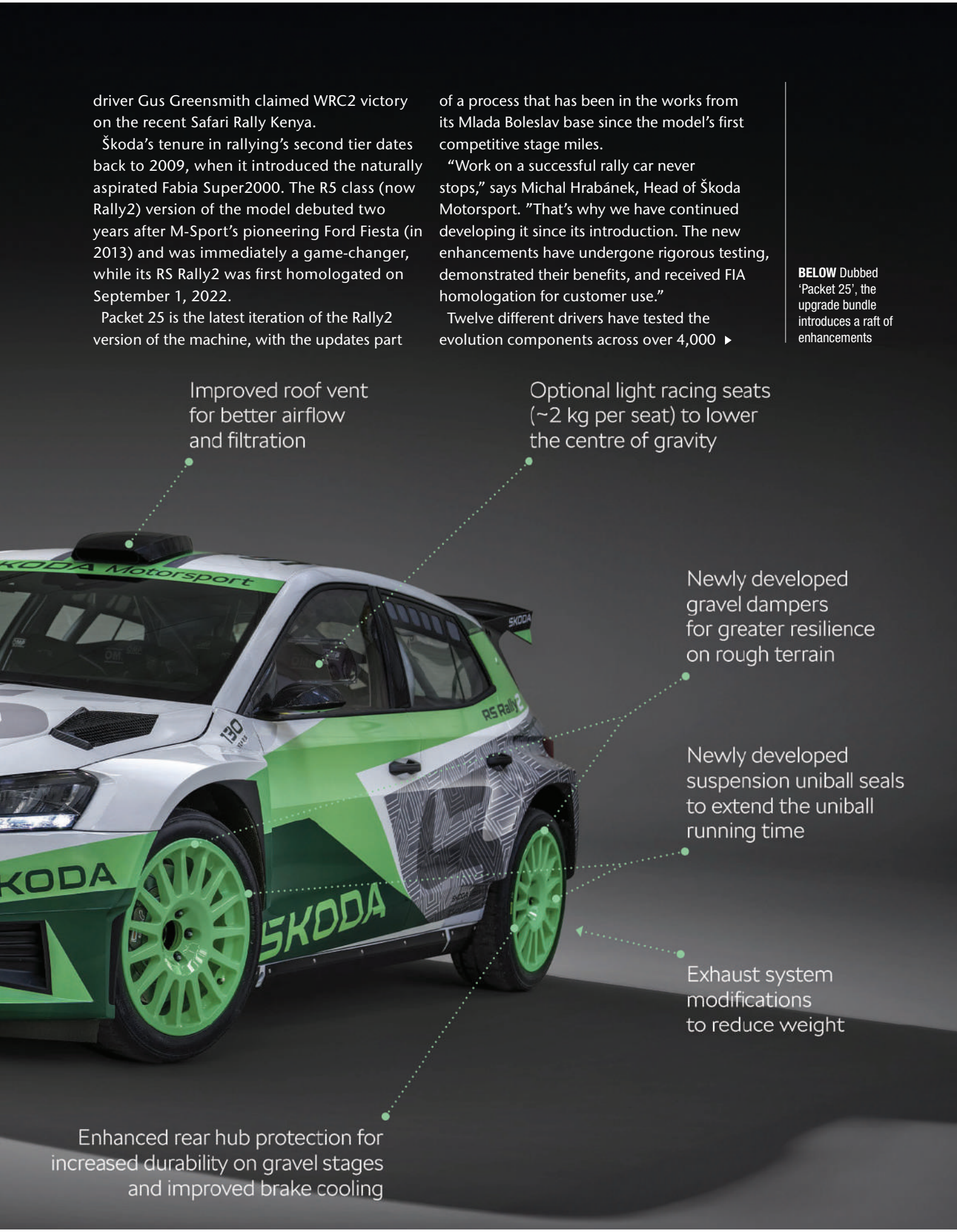
Škoda's tenure in rallying's second tier dates back to 2009, when it introduced the naturally aspirated Fabia Super2000. The R5 class (now Rally2) version of the model debuted two years after M-Sport's pioneering Ford Fiesta (in 2013) and was immediately a game-changer, while its RS Rally2 was first homologated on September 1, 2022.

Packet 25 is the latest iteration of the Rally2 version of the machine, with the updates part of a process that has been in the works from its Mlada Boleslav base since the model's first competitive stage miles.

"Work on a successful rally car never stops," says Michal Hrabánek, Head of Škoda Motorsport. "That's why we have continued developing it since its introduction. The new enhancements have undergone rigorous testing, demonstrated their benefits, and received FIA homologation for customer use."

Twelve different drivers have tested the evolution components across over 4,000 ▸

BELOW Dubbed 'Packet 25', the upgrade bundle introduces a raft of enhancements


Improved roof vent for better airflow and filtration
Optional light racing seats (~2 kg per seat) to lower the centre of gravity
Newly developed gravel dampers for greater resilience on rough terrain
Newly developed suspension uniball seals to extend the uniball running time
Exhaust system modifications to reduce weight
Enhanced rear hub protection for increased durability on gravel stages and improved brake cooling
ŠKODA Motorsport
ŠKODA
R5 Rally2

> *A new exhaust manifold lowers the energy required for in-cylinder gas exchange by 27%"*

kilometres, on snow and ice, gravel and tarmac, but where Škoda also gains, is with the relationship it maintains with its customer teams.

Since the RS Rally2 was released over 150 units have been sold, the cars achieving more than 25,000 starts that have resulted in more than 7,000 podiums. It's said that a weekend of the year no longer goes by without at least a dozen Fabia Rally2 machines taking part in events around the world, from the smallest domestic single venue rallies to World Rally Championship rounds.

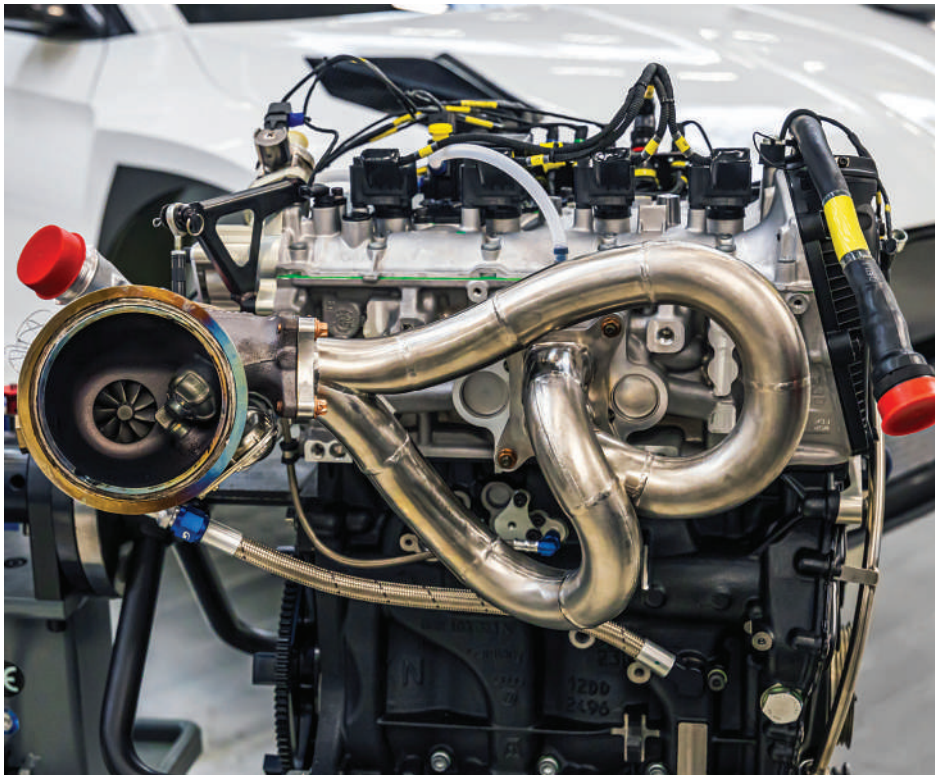
Shared data

"We're quite lucky because we're able to collaborate with our customer teams and we share data both ways, that's something we do as Škoda Motorsport," notes Jan Hrbek, Product Communications spokesperson. "We test the cars, and we also get some testing miles with the customer drivers who are our test drivers. We gather all this data from all of the scenarios and different environments that the car is racing in.

"We are testing continually through the year. Even if we are not preparing any upgrade like Packet 25, we are still doing a lot of testing in all the conditions we can get – we have covered all the bases you can reasonably expect to meet on a rally. Of course we also get the cars from our customers for recommissions and rebuilds after a certain period of time and certain number of kilometres driven, so we get all of the data from rebuilding the cars ourselves too."

Asked if the recent introduction of stiff opposition was a factor, notably with Toyota's new Yaris Rally2 and upgrades to M-Sport's Fiesta, Hrbek adds: "Of course the competition speaks into our decisions, but this is mostly about Škoda developing the car further and finding new solutions and to improve the car overall; it's mostly just us finding new ways to make the car quicker rather than just looking at what the opposition is doing."

RIGHT Gus Greensmith's triumph on Safari Rally Kenya couldn't disguise the fact that the drivers needed more ammunition to deal with the threat posed by Toyota



BELOW The engine-related components of 'Packet 25' are designed to improve the thermodynamic characteristics of the Fabia RS Rally2's powertrain

But what of the improvements? Using the process of homologation jokers allowed within the FIA regulations of the category, Škoda has made a raft of changes, notably to the engine, and suspension.

Power games

Externally, the most obviously redesigned component for those looking closely is the new roof vent, improving airflow into the cockpit while also increasing filtration and preventing water from entering the car. Comfort-wise, that introduction is coupled with new base-level seats, two kilograms lighter per unit, that also help lower the Fabia's centre of gravity.

But it's under the bonnet where the most improvements have been made. While Škoda is obviously coy at this stage about how it has achieved its gains, it stresses that the majority of the improvement comes from the exhaust side of the four-cylinder, turbocharged, direct injection engine from the marque's EA888 Gen2 Lk1, 2.0 TSFI range (with displacement reduced to 1620 cc).

While the engine continues to use an FIA-mandated 32 mm air restrictor on the inlet side, exhaust gas flow optimization at the other end of the internal combustion process has been a key focus area. A new exhaust manifold is said to lower the energy required for in-cylinder gas exchange by 27%.

Weight reduction from the exhaust ▶

system has also been made, while revisions to the mapping in the Magneti Marelli management of the four-cylinder unit have resulted in an undisclosed increase in power output, and a more pronounced engine note.

"I can see significant progress in engine response," notes Robert Virves, one of the 'Packet 25' test drivers. "It's even sharper and has incredible power in higher gears. The engine sound with the new exhaust is beautiful and aggressive!"

On the suspension side, with Škoda having worked with ZF for a number of years, the latest focus as part of Packet 25 has been on making gains in loose-surface gravel performance. The new MacPherson strut dampers are designed to withstand higher loads and improve durability on demanding gravel stages.

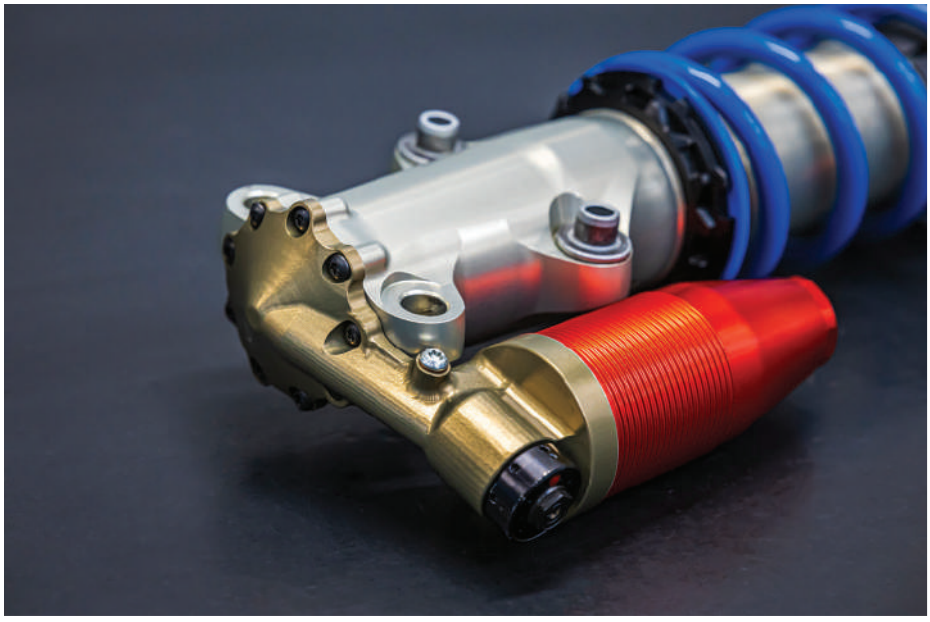
The damper reservoir has been evolved, along with internal components, including seals, while working to maintain the previous damper weight. Increased rear upright protection has been implemented to extend the lifespan of driveshaft boots (connecting the wheels to the Xtrac five-speed sequential transmission), the Alcon brake callipers and brake cooling hoses.

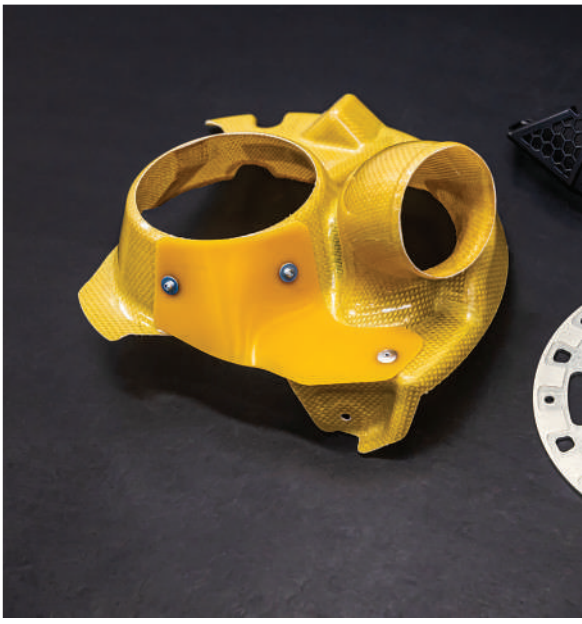
New seals for the suspension's uniballs have also been developed to, in Škoda's words, "significantly extend the running time of the uniballs," as part of an effort to reduce overall maintenance costs for customers.

With thousands of Rally2-speciation machines now out on the world's rally stages from the various manufacturers, it's cost savings like those, coupled with the performance gains found, that could influence a buyer's decision.

Fresh-built cars will automatically be given the Packet 25 upgrades, while existing machines can be

BELOW Informed by extensive test data, 'Packet 25' takes the marque's WRC2 contender to a new level





RIGHT Upgraded dampers and rear upright shielding aim to improve durability and control on gravel rounds

> *"I can see significant progress in engine response"*

upgraded with almost immediate effect.

When first introduced, the specified price for a Rally2 (then R5) car was €180,000. Ten years on from Škoda's first R5 offering, the controlled base price is €260,00, taking into account an 'index of inflation' added annually. But even then, the reality for going rallying competitively is a little different.

"There is a great answer from our boss Mr Hrabánek that goes like: 'There is a base price that we need to honour, so if you come to us and say I want the very basics of what the car is, then it's €260,000," says Hrbek. "Then of course there are some add-ons, other features that you can pay for with the car, such as additional lights, different seats for different body types and many different features you can pay for. As Mr Hrabánek says, the final number for most of the cars we sell is €330,000, because people want extra equipment."

Even despite his victory on the gruelling Safari Rally Kenya recently, British driver Gus Greensmith, one of the 12 to be part of the development of the Packet 25 upgrades, went on record to say the Czech brand needed answers to Toyota's overall performance in WRC2.

The marque hopes that the outlined changes will not only help lift it back to the top of the super-competitive category's pecking-order, but help maintain its impressive customer sales. RT

V10S GO VIRAL!

Sergio Rinland reflects on the growing momentum behind those calling for F1's return to naturally-aspirated V10 engines

BILL Gates is investing in the development of a drug to stop cows' flatulence, which contributes some 9% of the CO2 emissions to the atmosphere globally, where mobility is contributing 14%. So, welcome, Bill! Someone else is helping to reduce greenhouse gases other than motoring!

Not that the billionaire has a monopoly on controversial proposals right now.

We are less than a year away from the new 2026 Formula 1 regulations, with many impending changes for the aerodynamics, weight, dimensions and power unit. In order that none of the boardrooms get too comfortable while spending millions on the new 1.6-litre V6 turbo engines and the upgrade of a hybrid system that will account for nearly half of the power delivery – a fantastic technological breakthrough after 12 years of hybrid engines at the pinnacle of motorsports – momentum is growing in support of a faction intent on throwing a spanner in the works: let's bring back naturally-aspirated V10 engines!

Kiss goodbye to the expensive and complex hybrid system? Can you believe it? Just as we are entering an unprecedented era of prosperity for Formula 1, with six OEMs supplying engines or fielding their own teams – Ferrari, Mercedes-Benz, Honda, Ford, Audi and Cadillac – all attracted by these new regulations, this upheaval is being discussed (seriously, I'm told) by the FIA and the current Formula 1 teams.

The very reason why Honda made a U-turn and returned to supply engines to Aston Martin, and why Audi and Cadillac decided to enter Formula 1 with their own teams, is that they consider the 2026 regulations to be closer to some of their production offerings (together with EVs and perhaps Hydrogen FC cars).

ABOVE Not since Renault's victorious R25 in 2005 has a V10 been heard in F1

Up to this year, Formula 1 engines enjoyed energy recovery from the exhaust thanks to the MGU-H or turbo-compound. It's a fantastic technology, which gave Mercedes-Benz a huge advantage at the beginning of this hybrid era, but which to all intents and purposes is useless in a road car.

Some manufacturers were not attracted by the prospect of spending a fortune on a technology that was not going to be used. The demise of the MGU-H and the increase in power from the MGU-K and battery had sufficient attraction for Honda, Audi and Cadillac to give in and enter Formula 1. Now they can use the sport to develop and promote technologies that are relevant to their road cars.

I would love to be a fly on the wall of those OEMs' boardrooms right now!

There are many opinions on this subject. One former Formula 1 Team Principal told me last week: "I could be in favour of retuning to naturally aspirated V10 engines. They sound great and if the new V6 hybrid powertrains are not that relevant to production cars, then we may as well run smaller and lighter cars and have a great spectacle."

He had a point, so the question is: how relevant are these 1.6-litre V6 engines with a nearly 50/50 electric motor and battery contribution to road cars? Every manufacturer these days has parallel hybrids in their line-up to different levels of electrical contribution, so you could say that a Formula 1 hybrid engine running on CO2-neutral e-fuels is very relevant for the present state of mobility. But, is that the future? No one knows.

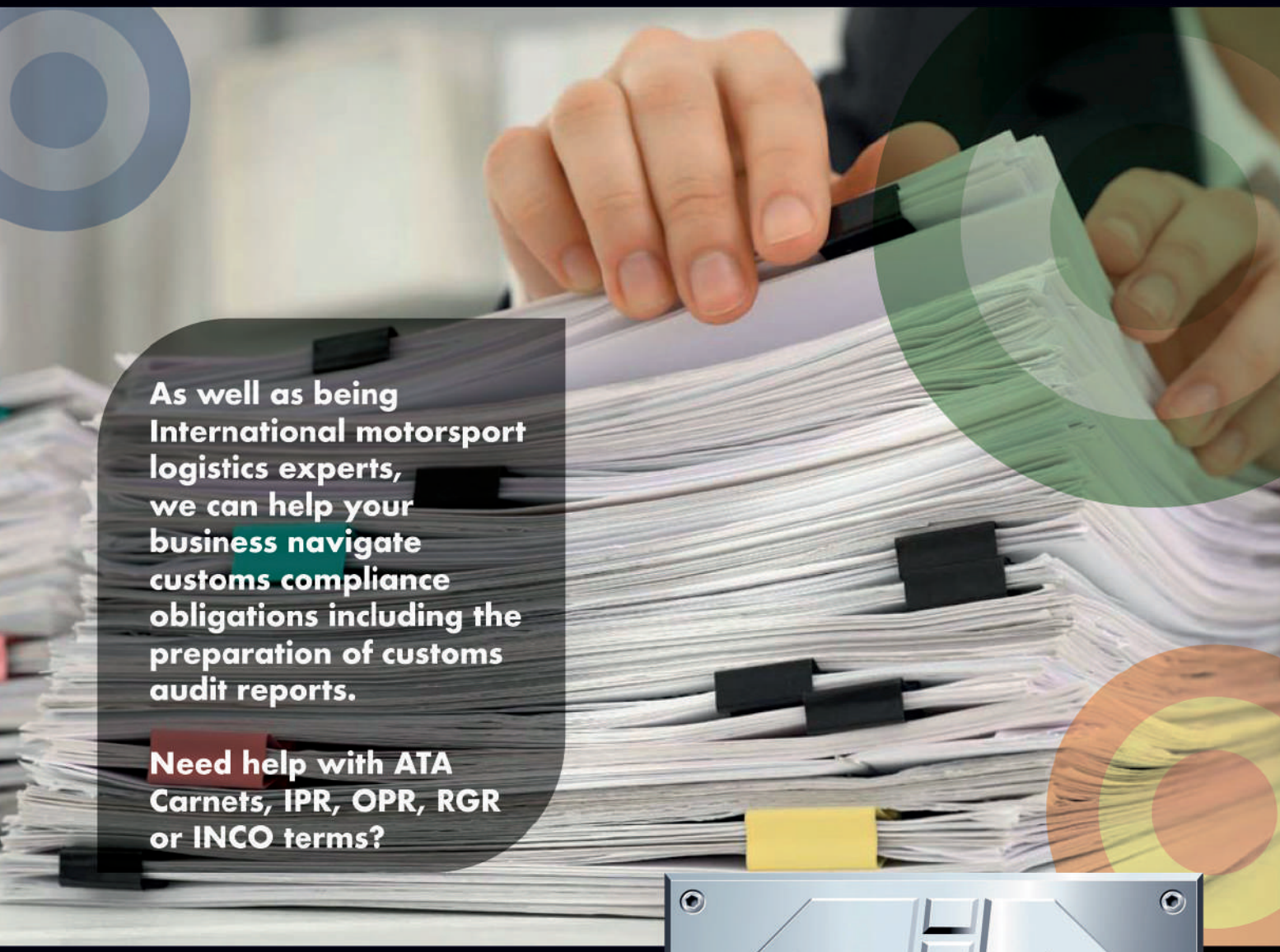
The direction of mobility for the foreseeable future will be a mix of ICE only, parallel hybrids, series hybrids, electric and Hydrogen FC range extenders. There is no silver bullet, so we may as well use F1 to develop and promote one of them.

The question is, which of all those technologies is better suited to a racing car? And the answer is: a normally aspirated engine running on CO2-neutral e-fuel, so whoever threw that spanner into the works, even if for the wrong reasons, is not that far from the truth.

We all agree that the current F1 cars are huge, heavy and not very agile. The main culprit is the PU technology, plus the weight and packaging room required for adding to the safety structures around the cars. The way the F1 parallel hybrid works, with the electric motor power going through the ICE crankshaft, creates a big challenge for the engine designers. Is that the way the production cars have their hybrid system? Not many, the common way is to place the electric motor *after* the engine (as in LMDh cars) either before or after the gearbox. So, we go back to the relevance argument.

We can discuss the advantages, disadvantages and relevance of all these technologies until we are blue in the face, but the answer has to revolve around *the relevance of these technologies to motorsport*, not the other way round. Sorry, OEMs! RT

We are proud to have won the Motorsport Industry Association "Business Excellence Award" for our work supporting MIA members with their international trade compliance.



As well as being International motorsport logistics experts, we can help your business navigate customs compliance obligations including the preparation of customs audit reports.

Need help with ATA Carnets, IPR, OPR, RGR or INCO terms?

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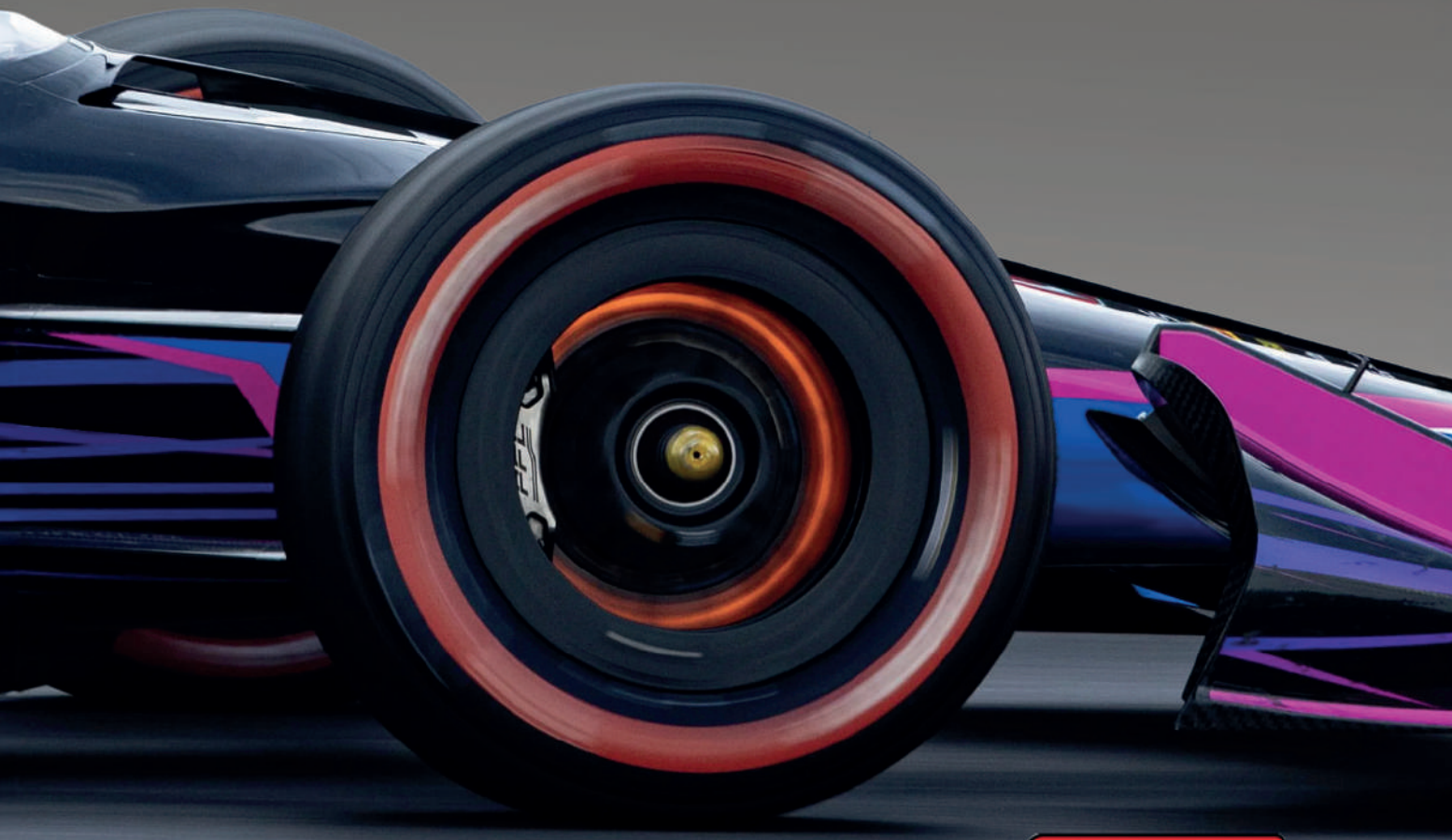

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